Report on field visit

Construction of Pilot Low Cost Houses (LCH) Project for the Disaster Affected Families of Bangladesh

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CRAterre project reference n° BDG006

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Acknowledgements

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all the people that we met for taking the time to answer to our questions; to the artisans for explaining us their building knowledge and to the inhabitants for opening their homes and dedicating to us a little bit of their time.

Field visit report

1. Background

Bangladesh

The People's Republic of Bangladesh is located at north of the Bay of Bengal, and it is surrounded by India, with a small border with Burma. The borders of present-day Bangladesh were established with the partition of Bengal and India in 1947, when the region became East Pakistan. Its independence was proclaimed in 1971 following a war with Pakistan.

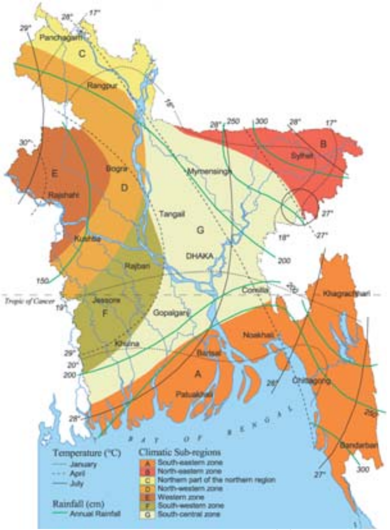
With an estimated population of about 142.3 million (*Preliminary Census 2011*) and over than 1 050 inhabitants/ km², Bangladesh is one of the most densely populated countries in the world, while also being one of the poorest countries in Asia.
The majority of the population is mainly dependent on day labouring, agriculture, small trade, fishing and rickshaw or van pulling.

Most part of the country consists of a huge flood and delta plain. 70% of the total area of Bangladesh is less than one meter above sea level and 10% is made up of lakes and rivers. Geographically, Bangladesh is one of the most disaster prone countries in the world due to its geographical location. Floods, cyclones, tidal waves, landslides, tornadoes, riverbank erosion, drought and earthquakes are very common hazards.

Given the large difference in the types of existing risks and cultures, the coping strategies adopted by the same social groups living in different parts of the country significantly differ from one region to another.
Each community has its specific local knowledge related to local risks, natural ressources and people lifestyle and culture. However, natural hazards associated with existing vulnerability often exceed people capacity to cope and manage crisis situations.

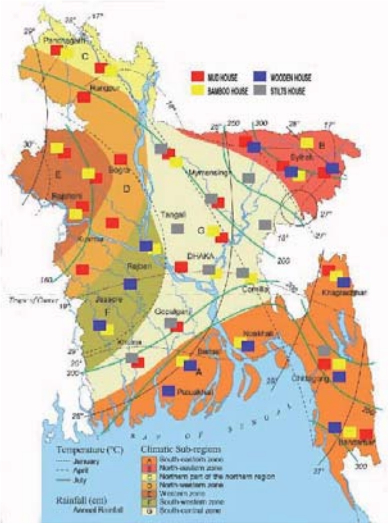
Source: Wikipedia

Geography



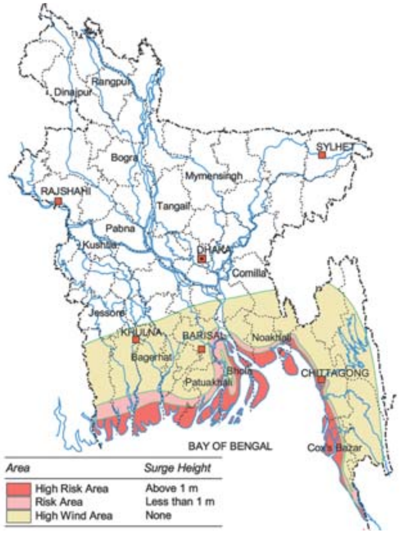
Source: Rashid, Haroun Er, 1991

Climate



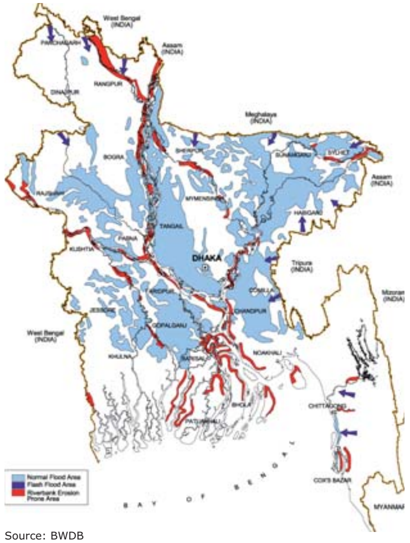
Source: Rashid, Haroun Er, 1991

Traditional building typologies



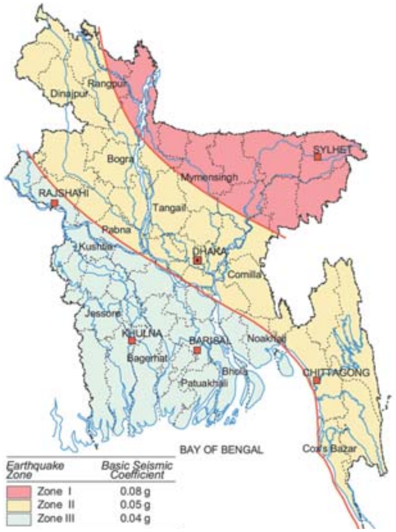
Source: SPARSO

Cyclone affected areas



Source: BWDB

Flood affected areas



Source: GSB

Seismic areas

Project partners

Caritas Bangladesh (CB)
Founded in 1967, CB is a national non-governmental organization recognized by the Bangladeshi Government. Its action is directed towards the poorest people, especially marginalized and landless people and communities living in coastal areas, particularly vulnerable to recurring natural hazards. The work of CB is strongly anchored in the work regions, with a organizational structure that spans from national to village level. At present, CB is working in 136 upazilas (subdistricts) but, during emergencies, Caritas is operational in any part of the country.

The work of CB is based on different priority areas including emergency response and disasters preparedness, sustainable agricultural development, health, education, rights awareness and climate change.

The action of CB is based on a strong involvement of local communities to ensure their empowerment and capacity building, particularly for recovery and crisis management.

Since 1970, CB regularly develops activities related to emergency response, rehabilitation and housing reconstruction following numerous crises (floods, cyclones, landslides, wars, fires, drought, refugees,...).

Bangladesh University of Engineering and Technology (BUET)
Univesity of Engineereing based in Dhaka, is one of the most prestigious institutions for higher studies in Bangladesh.

Role in the project:

technical support for the design, the research and tests of materials and construction elements to be used for the LCH project.

CRAterre
French association and university laboratory of the Superior National School of Architecture of Grenoble, developing an approach that dynamically link diagnostic, research, experimentation and implementation, based on a mutual exchange between field practice and academic researches.

The work areas focus mainly on the scientific study of the earthen material, the conservation and management of the architectural heritage, the identification and implementation of development strategies for sustainable human settlements and risk reduction.

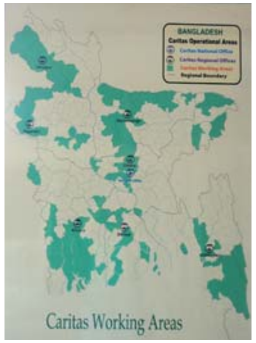
The CRAterre action focuses on capacity building and empowerment of local populations on the basis of local resources (materials and know-how), by enhancing local knowledge in the field of infrastructure and housing construction.

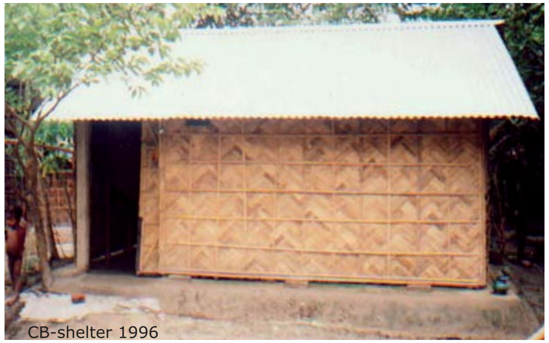
Role in the project: technical support for :

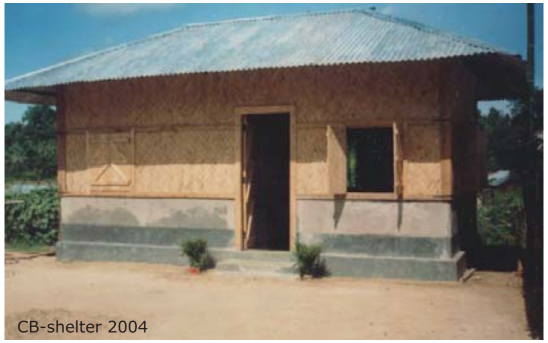
- the development of tools and methods to analyze the strengths and weaknesses of the vernacular housing;
- capacity building for the definition of strategies to improve local habitat, considering cultural, social, technic, economic and environmental factors
- the implementation of projects aiming to improve habitat through a strong component of risk reduction and disaster preparedness.

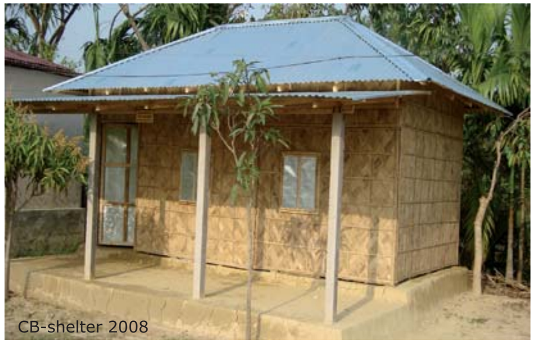
Secours Catholique / Caritas France
Role in the project: donor

Caritas Luxembourg
Role in the project: donor




CB-shelter 1996


CB-shelter 2004


CB-shelter 2008

Project background

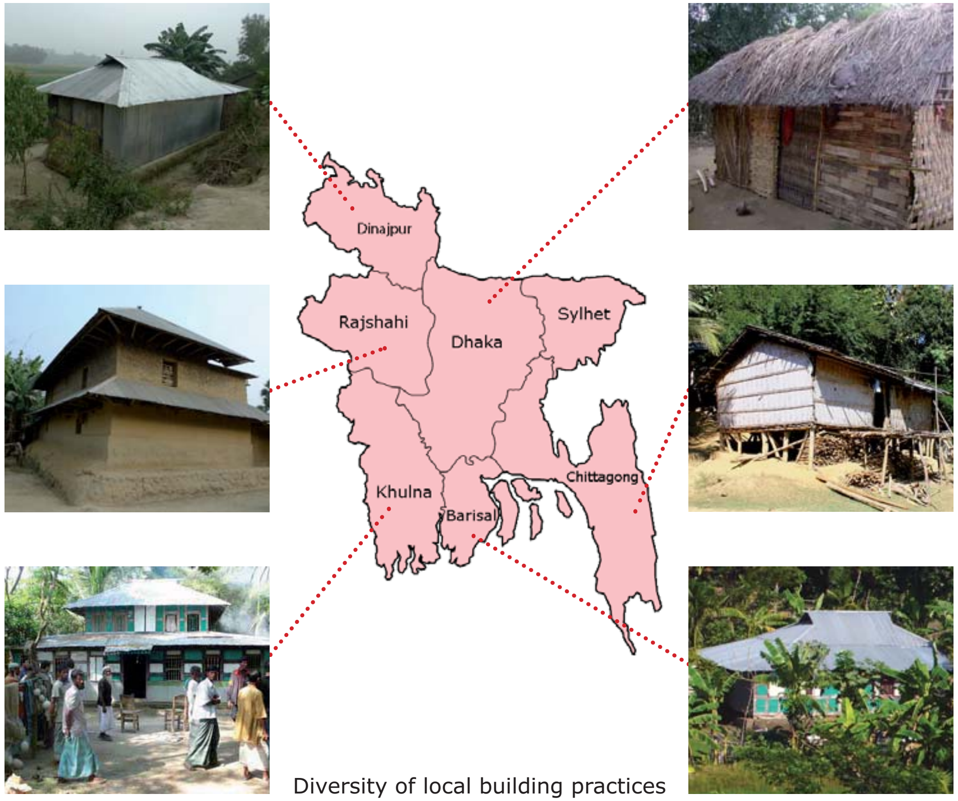
Between 2007 and 2009, Bangladesh was hit by two very strong cyclones (Sidr and Aila). During the housing reconstruction projects (2007-2010) following the impact of these two cyclones, a partnership between Caritas Bangladesh, Secours Catholique/Caritas France, the University of Engineering and Technology of Bangladesh (BUET) and CRAterre, allowed developing a different way to conceive and implement low-cost housing (LCH) projects.

Alongside with the construction of 500 standard LCH, a pilot phase has been implemented in two regions to adapt the design of 50 LCH to local resources (skills and materials) and risks through a community participatory approach.

Following these programs, the following gaps have been identified:

- in Bangladesh different types of disasters destroy a huge number of houses. One-third of them are self-recovered and maximum one third are recovered with the assistance of government and other agencies. The remaining one-third of the households cannot rebuild their destroyed houses. There is a huge gap between housing recovery and existing needs after a disaster.
- Houses rebuilt in the same area by different agencies correspond to a great variety of models and technologies which are rarely reproduced and reproducible by the people, due to their high cost and to the complexity of the used techniques. A large gap exists between proposed solutions and existing capabilities.
- Each community has developed its own building techniques and practices based on locally available resources (know-how and materials), but the relevance and the effectiveness of certain solutions are generally not considered in re-construction projects. An understanding of local knowledge and building practices is necessary for the identification of appropriate technologies for LCH construction.
- In Bangladesh, about 83% of the population lives in buildings built without the support of any architect and/or engineer. In the educational institutions working on construction sector, a very small part of the researches focuses on this type of construction. A large gap exists between technical knowledge developed and taught in the universities and building practices implemented by the majority of the people.

On the basis of these findings and of the positive experience of the previous pilot project, a 3 years disaster preparedness program has been launched.
This program consists on the analysis of specific local features in six different regions affected by different types of natural hazards (cyclones, floods, earthquakes, landslides, cold waves) in order to develop preparedness and risk reduction strategies for the enhancement of local building practices and coping capacities for LCH reconstruction in post-disaster situation as well as for preventive structural improvement. With the pilot phase already completed, this program provides a national coverage.



Diversity of local building practices

The project

Project title

Construction of Pilot Low Cost Houses (LCH) Project for the Disaster Affected Families of Bangladesh

Overall objective

Enhancing local capacities to cope with local risks by improving local building practices and by directly involving local communities into the definition of technical proposals based on local resources and risks and adoptable by people for vulnerability reduction and preparedness against future crises.

Specific objectives

- Local communities and CB staff capacity building in disaster risk reduction and preparedness for future crises
- Construction of new houses for 84 families in six regions of Bangladesh
- Involvement of local communities in all project stages
- Exchange between academic technical knowledge local/traditional knowledge
- Knowledge sharing among CB staff and other institutions

Expected outcomes

- Sharing knowledge and expertise between CB-BUET team and local communities for the construction of LCH
- Enhancement of CB technical capacities through the technical and methodological support of the involved partners
- In 6 different regions, construction of 84 pilot houses adapted to local risks and training of local builders (artisans and beneficiaries) on the used techniques
- Integration of the knowledge and the expertise acquired during the project in CB and local communities practices and strategies for crisis preparedness and response

Activities

- Analysis of existing building practices and know-how, available resources and local risks in six regions of Bangladesh
- Design of a concept for low cost housing models based on the characteristics of the local context
- Exchanges between academic institutions and local communities
- Organization of regional and national workshops

Project implementation stages

1st year (2011-2012):
- survey in 3 regions (Chittagong, Rajshahi, Dinajpur)
- design for the construction of 30 pilot houses (10 per region)
- construction of 30 pilot houses

2nd year (2012-2013):
- survey in 3 regions (Mymensingh, Shylet, Khulna)
- design for the construction of 30 pilot houses (10 per region)
- construction of 30 pilot houses

3rd year (2013-2014):
- assessment of the pilot houses
- adaptation of the pilot house models
- construction of 24 pilot houses (4 per region) in the six regions

Project duration 1 Octobre 2011 - 30 September 2014 (3 years)

Additional elements

- Participatory methodology is at the heart of the project to ensure a better responding to people needs
- Houses will be equipped with basic facilities (minimum living area corresponding to Sphere standards, sanitation); they must have a lifespan of 20-30 years and take into account the cultural, economic, environmental factors and the existing resources.
- Criteria for the selection of the project areas:
    - poorest unions at Upazila (sub district) level
    - frequently affected by different natural hazards
    - very limited or no sufficient government response
    - small number and limited coverage of NGOs
    - well established relationship between with local communities and government institutions
    - emergency disaster responses previously implemented by CB in the area

2. Terms of reference for field visit

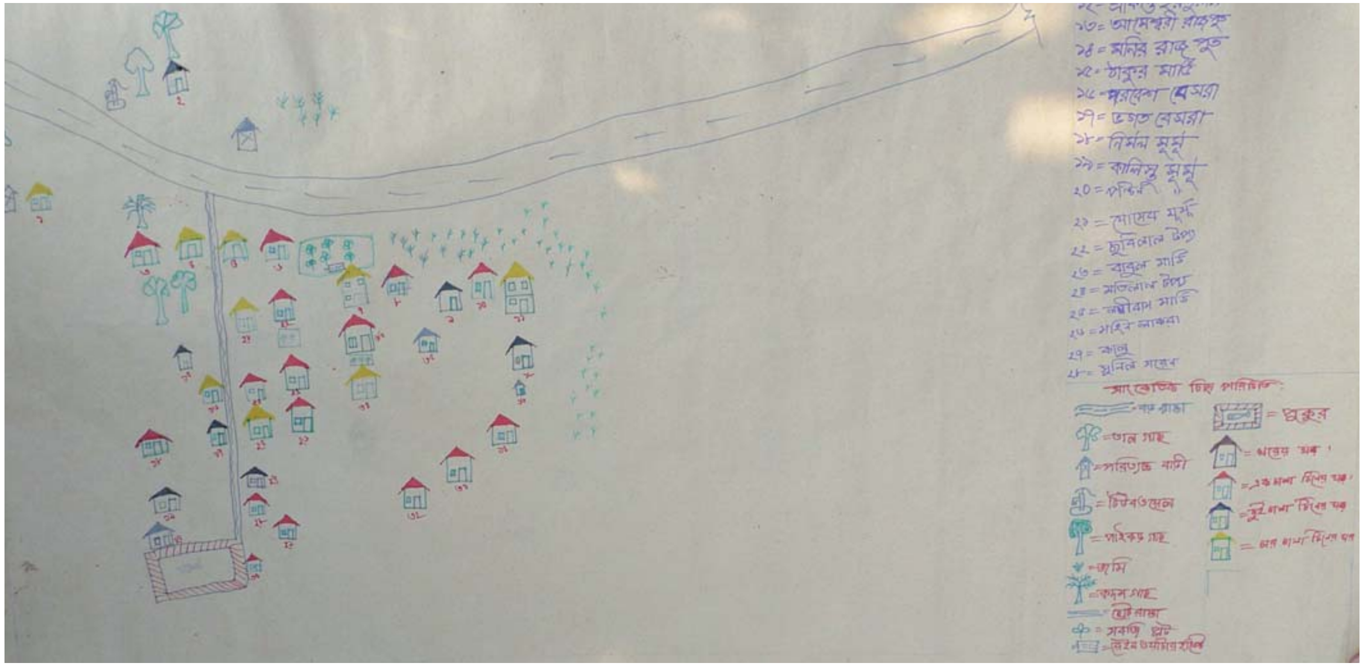
Objective

The development of LCH design for different regions is based on the analysis of the characteristics of each area.

In relation to the ongoing PhD thesis, the field visit had the objective to support CB in the development of tools and methods for the analysis of local architecture and construction practices, strengths and weaknesses of vernacular housing, existing skills and know-how, available resources, local risks, as well as local capacities to cope with these risks.

More specifically, in close collaboration with CB and BUET teams, the work has consisted in:
- development of survey questionnaires
- survey implementation
- synthesis of collected information
- first proposal for pilot houses design

Period 22 November 2011 - 21 December 2011



Hiradanga (Rajshahi Division): village map with housing differentiation by building typologies

Methodology and tools for survey

Preliminary phase

Different questionnaries have been developed:

- A questionnaire used by BUET and CB in a previous project (post-cyclones Alia and Sidr reconstruction program)
- in relation to the ongoing PhD thesis, different criteria to consider for the analysis of local construction practices have been defined. Some survey forms related to a field survey methodology have been developed in relation to different analysis levels: housing, context, resources and capacities.

After discussions between the project partners, some elements were added to the questionnaire prepared by BUET.

Survey implementation

- team for field survey:
    - Ratan Kumar Podder: engineer, program coordinator, CB National Office
    - engineers, CB regional officers in charge of the LCH program in the surveyed area
    - local supervisor for LCH program
    - Shamima Nasri : BUET master student
    - Annalisa Caimi : architect, CRAterre-ENSAG PhD student

- Data collection on number of households and existing building typologies, on the basis of discussions with local communities and village maps drawn by local population; work done by the local supervisor and submitted to the team at the arrival in the region

- Meeting with the community of the surveyed area: introduction of the project and of the team members, explanation of the project objectives and implementation strategy, data collection about the village and its social, economic and natural environment

- Transect walk: identification of the building typologies and the houses to be surveyed

- Housing survey and interview with inhabitants (technical and detailed survey implemented at the same time)

- Meeting with local community and artisans: data collection on housing, building process, available resources, existing skills and know-how

- Meeting with local artisans: data collection on building materials, costs, availability, required quantity, provenance

- Daily debriefing among the survey team to share and to verify the collected data, to identify the missing information, to refine the survey methodology and to define the role of each team member

- Duration of the survey in each area: about 4 days

- Roles assumed by the team members during the fieldwork:
    - facilitator of group interviews: program coordinator CB national office
    - technical survey: BUET master student, regional officer, local supervisor
    - detailed survey (interview with inhabitants): program coordinator CB national office and CRAterre PhD student

- After report preparation, some criteria to be considered for pilot houses design were discussed between team members; these criteria are indicative and may be modified during the project

Comments following the survey phase

Survey methodology, tools and implementation

- The understanding of the objectives of both technical and social parts of the questionnaires, the application of the survey methodology and the use of the survey tools by the regional officers are very important factors in order to implement the survey on the existing building practices in other regions. Furthermore, an adaptation of the questionnaires to the characteristics of the area to be analyzed by a person who already knows it could help to better identify the elements that have to be investigated.

- The appropriation of the survey tools and methodology by the CB staff is indispensable to allow conducting further analysis in an autonomous way without the support of any external resources (such as CRAterre and BUET).

Project

- Although covering a 3 years period, the project is essentially divided into two parts:
  1: primarily focused on the project product (LCH pilot houses) but allowing to test and to implement all the stages of the project process (survey, design, construction, adjustment, evaluation/validation) for the construction of 10 houses in each region.
  2: mainly focused on the project process and allowing the CB staff to be trained to the survey methodology and to practice the proposed approach with the survey implementation in other areas and the design and the achievement of other 4 model houses in each region.
  This separation allows testing and adjusting the process before to share it among the CB staff. However, if regional officers are more involved, they could contribute to improve the survey questionnaires and methodology; furthermore, they could help to better identify the elements to investigate in relation to the area features.

- For the pilot houses, different models corresponding to different levels of costs could be studied, providing different solutions for the improvement of the existing building practices in relation to the different economic levels existing in the local community. The advantage of this proposition is that more people could benefit from the project by providing different technical solutions that could be implemented for possible future improvements according to the capacities of each family.

- For Rajshahi and Dinajpur regions a shift in the planning is to be expected: in fact, technical studies (particularly in relation to earthen building) require more time than expected. The design strategy will be completed before the rainy season (spring 2012), however the construction phase have to wait until the next dry season (November 2012).

- A statement of local capacities in terms of post-disaster response management (needs, project dimension, existing skills, possible collaborations) and available resources after a disaster (reusable materials, available materials on the local market, difficulties for material supply) could allow to integrate the constraints existing in crisis situation in the house design and implemented activities.

Additional comments

In addition to the technical design for LCH, taking into consideration the following factors could contribute to an appropriation of the suggested solutions by the local population and to an enhancement of local capacity for crisis management:

- Present and future accessibility (for direct and indirect project beneficiaries; in normal time and in crisis situation; resources availability on the long term; economic situation)
- Resilience (disaster risk reduction at housing and village level in relation to local community capacities)
- Potential for duplication of the suggested building solutions considering technical and economical capacities of the local people
- Socio-economic impact (local market, enhancement of existing know-how, improvement of local resources)
- Statement of local response capacities in relation to crisis dimension (community-based organizations and CB local, regional and national level)

- In addition to the beneficiaries of the pilot houses, if the whole community is targeted and involved in the project by training, education, demonstration and other activities (eg. community plantation), others people could indirectly benefit from the project.

- Relying on the existing infrastructures (eg. training centres) to include some project activities (eg. bamboo and wood treatment, building details,…) to the current proposed training can allow to other persons and/or communities (living nearby the project area but not directly concerned by its implementation) to benefit from the project propositions with a positive impact both in terms of constructive knowledge (improvement of the housing sector) and existing skills (enhancement of existing know-how) development.

- The development of training materials and communication tools (such as handbooks, posters,…) for both artisans and population would allow a wider dissemination of technical information and would rise awareness on good building practices to improve the lifespan of buildings and their structural behaviour under the action of natural hazards.

- The development of building principles, rather than a fixed plan house model, would allow for more flexibility in reconstruction situation, leaving to people the possibility to adapt the new construction to each particular situation (size and location of the plot, family size, economic capacity, private resources, risks, ...), while ensuring the integration of proposed technical improvements. Furthermore, this would allow greater adaptation and versatility of application in other areas of the same Upazila. The regional officers or the local supervisors may collect additional information about any differences or building solutions existing in other villages, so that these can be integrated in the LCH design since the beginning.

- The information collected through this project constitute an significant database that could be used by CB for other projects in the studied areas, and by other institutions (universities, NGOs,..) for research activities and pre / post-disaster interventions. Therefore, it is important that CB refines and shares about the survey methodology within its team, and that CB values its work by exchanging with other institutions. Moreover, regularly updating this database and sharing with other CB departments working in the regions concerned by the LCH project, would allow to get reliable and comprehensive information for each zone, useful for present and future projects.

Survey report

The following information are a synthesis of the data collected on the field in the three analyzed regions.

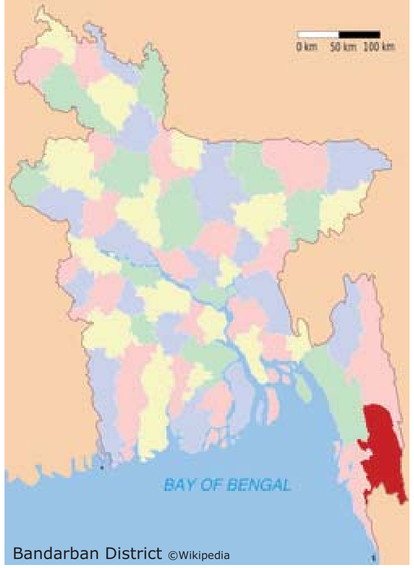
They have been structured on the basis of a common grid, however the information may vary according to local available data and survey conditions.

At the end of each part some points for the development of LCH pilot houses have been listed.
They have been determined on the basis of exchanges and discussions among team members and CB regional staff, during the field visit.
They are indicative and may be modified and improved during the project.

region 1

Chittagong Division_Bandarban District

context

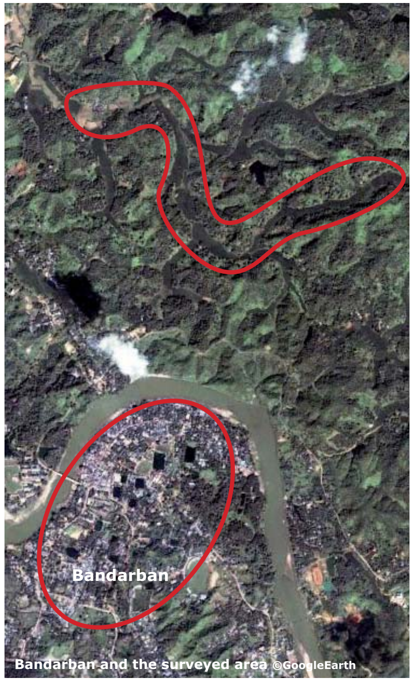


Bandarban District ©Wikipedia

SOCIO-ECONOMIC PROFILE

Population
- Marma and Tanchyainga indigenous tribes (adivasi)
- Barua communiy (bouddhists)
- Bengalis emigrated from the plain land (Muslims)

Main activities
- Farmers
- Artisans (carpenters, masons)
- Daily labours



Bandarban and the surveyed area ©GoogleEarth

LOCAL RISKS

Flash floods
- water level 30 -180 cm
- back to normal situation after 3 days
- local knowldge on preparedness
- past events:
  in 2001, water reached ceiling level;
  during past 50 years: 4-5 heavy floods

Earthquakes
- medium risk
- locally felt but any damaged
- past events:
  1997, Bandarban, M 6.1
  2003, 26 July, Kolabunia, Borkol, M 5.7
  2007, 17 January, Borkol, M 4.8
  2007, 11 July, Ruma, Bandarban
  2007, 7 November, Roninpara, M 5.2
  2007, 21 November, Bandarban, M 6.1
  2008, 23 August, Chittagong, M 4.9

Strong winds
- the exterior part of some cyclones can reach the region
- season: March-May, November
- past events:
  1989 and 1997: many roofs blown away
  1991: collapsed trees and roofs blown away

Landslides
- cause: heavy rains
- affected areas: agricoltural land, houses of landless or very poor people

Fires
- cause: propagation of fire from the kitchen during dry season

Rats flood
- cause: bamboo flowering (2007)

Cold waves

site

Upazila Sadar
Union Sadar
Ward 4

area rural

morphology
hilly with dense forest

access
30min by car or 1h by foot from Bandarban

settlement implantation site
top, slopes and foothills

facilities
none at villages level

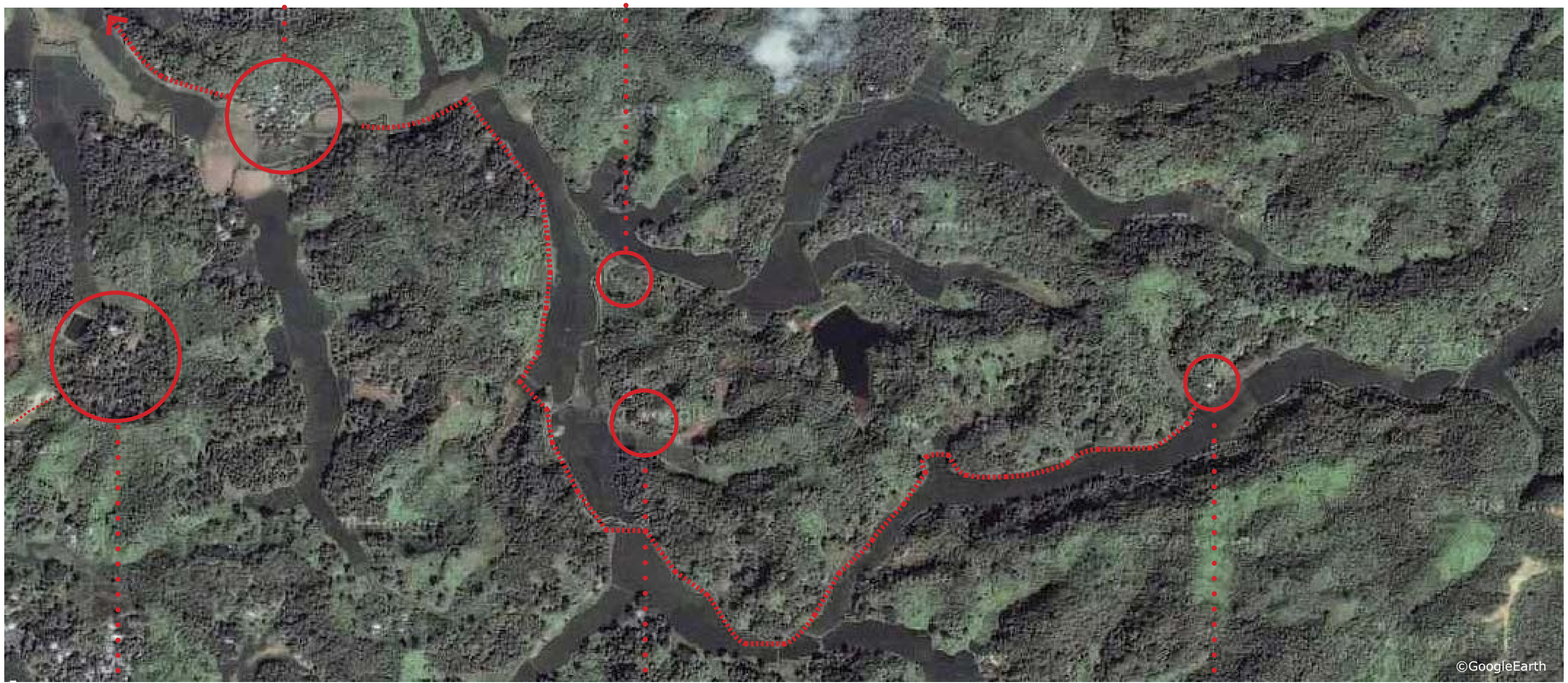
protection from local risks
- floods: none
- strong winds: trees

households 104
family sizes:
- small: 3-4 p
- medium: 5-6 p
- large: 8 p

other NGOs
CB-CTG (microfinance)
Grameen Bank (microfinance)
UNDP-GRAUS (mother and child)
BNKS (development)
UNICEF (education)
World Vision (scolarship)
CODEC (agriculture)

Limu Jhiri Para
51 houses:
34 on platform
17 on plinth
settlement pattern: clustered
access: easy, by brick road
water sources: 2water pumps, river

Limu Jhiri Boikkhong Para
5 houses:
4 on platform
1 on plinth
settlement pattern: clustered
access: very difficult, only by foot
water sources: 1 pond for rain water harvesting, river


©GoogleEarth

Limu Jhiri Manto Marma Para
26 houses:
11 on platform
15 on plinth
settlement pattern: clustered
access: very easy, paved road
water sources: 1 water pump, 1 pond

Limu Jhiri Maddam Para
6 houses:
1 on platform
5 on plinth
settlement pattern: clustered
access: difficult, only by foot
water sources: river

Limu Jhiri Aga Para
16 houses:
4 on platform
12 on plinth
settlement pattern: scattered
access: very difficult, only by foot
water sources: river

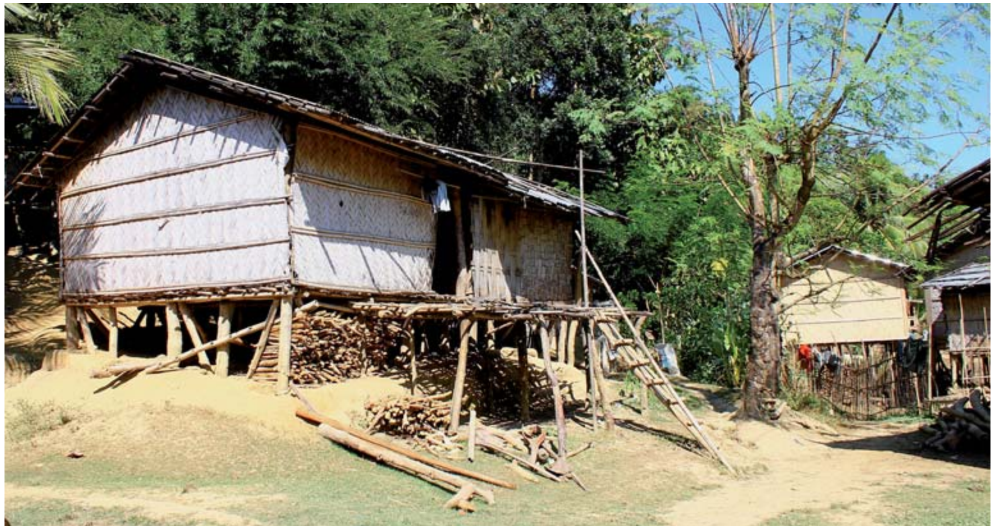
housing typologies

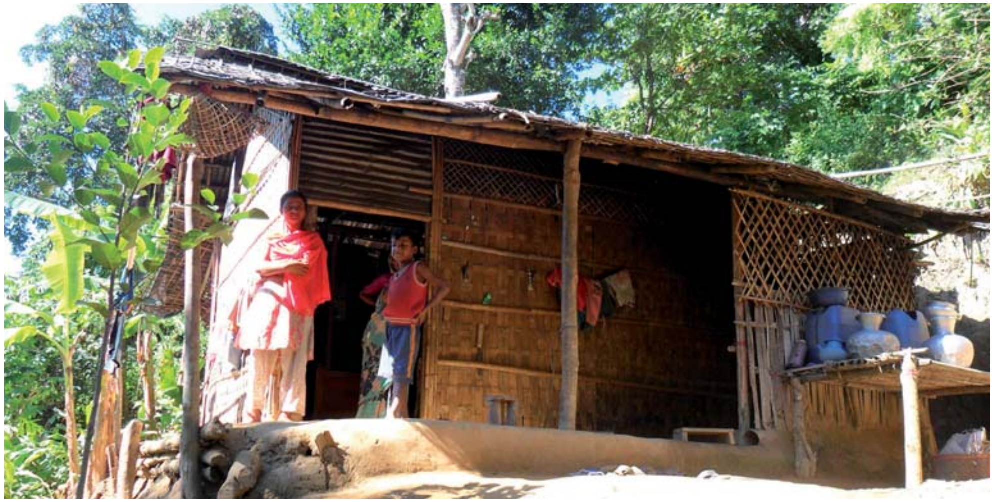
Two main housing typologies: traditional house and Bengali house.
The difference is determined by the social group (Adivasi or Bengali), financial capacities of the house owner and the availability of building materials.

A first differentiation can be made among traditional houses, based on local indigenous culture, and Bengali houses, flollowing Muslim religion rules.

The first ones correspond to stilts house type (Machan). However, due to high price and scarcity of wood and bamboo, stilts are increasingly replaced by a plinth. Spaces arrengement and dimensions of the house remain the same than stilt houses.

Bengali house is based on the same building techniques than traditional on plinth house. However, space arrangement and house dimensions are different.





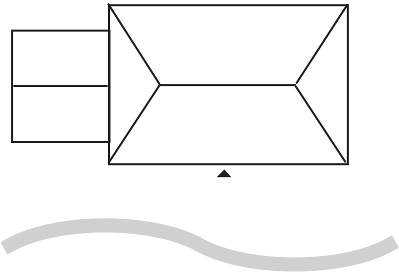
housing typologies

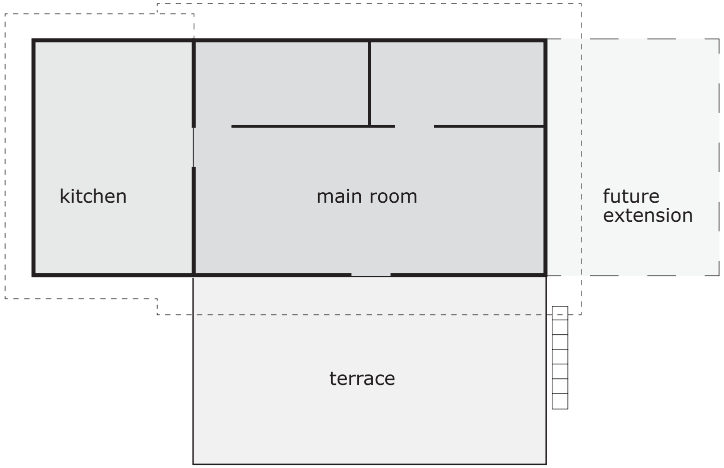
TRADITIONAL HOUSING

Orientation
The longest side of the house is parallel to the river or to the water souce and the main entrance is perpendicular to the river.

Space arrangement
The house usually consists of a main room constituting the basic core.
The creation of new rooms is done by dividing the basic core in parallel direction to the main facade, separating the public space, for visitors (raja room) and the private space for sleeping and storage.
The kitchen is placed in a separated room, accessible from inside the house.
Extensions are possible in all directions, but they are generally done on the short sides.
Stages of improvement generally include: main room, kitchen, exterior latrine, veranda.

In case of house reconstruction:
- the same space arrangement than previous house is maintained
- a part of the new house will be built on the same position of the previous one, at least on the half of both long and short sides





Dimensions
- 3x4.5 m
- 4.5x4.5 m
- 5.4x6 m

+ covered veranda:
depth 1.8-2.20 m ;
length of the main facade

+terrace (if machan house):
depth 2.40 m
length of the main facade

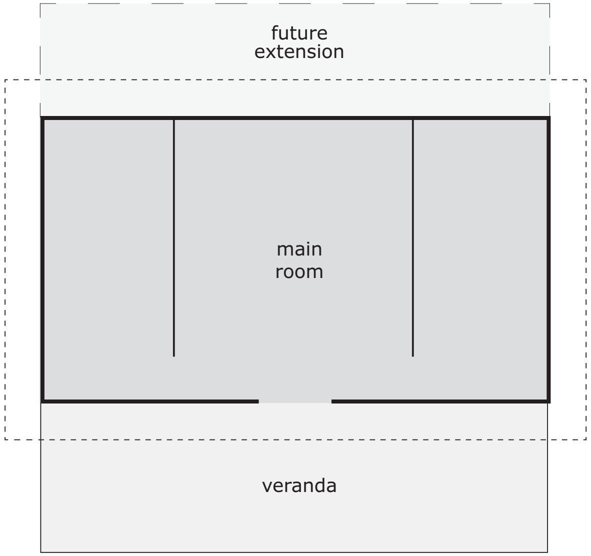
housing typologies

BENGALI HOUSE

Orientation
The longest side of the house is oriented on east-west direction.

Space arrangement
In the house, the main room occupies a central place and the access to secondary rooms, located on the sides, is made from this space.
Separation for new rooms is done in perpendicular way to the longest side
A verand runs along the main facade and sometimes hosts the cooking space.
Extensions are usually made on the backside, extending the roof of the basic core of the house.

Dimensions
The dimensions must be odd and even
Eg. If the short side is even, the long side should be odd
6 m x … as needed (odd number)
+ veranda: depth 2.1 m, length of the main facade

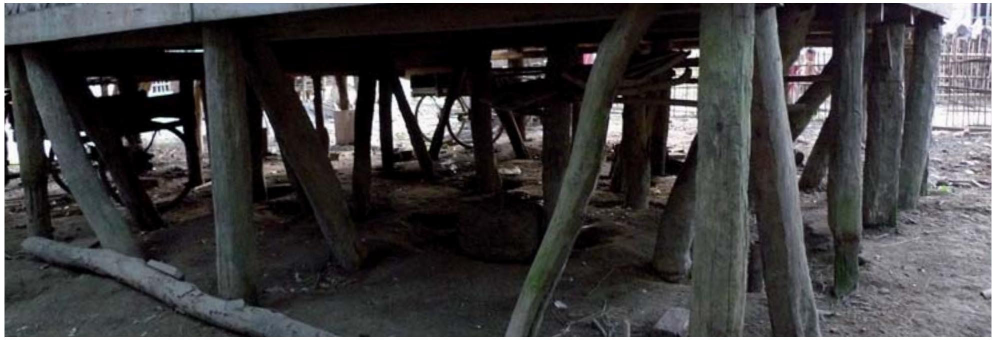


construction features

FOUNDATIONS/PLINTH

Machan house
- Wooden posts directly into the ground
- Elevation of the house as protection against animals and cold
- Platform:
  height: 1.5-2 m
  Access by a ladder made with steps curved into a trunk

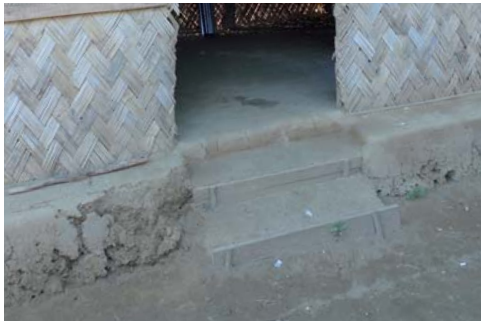
Plinth house
- Mud plinth, rarely brick plinth
- Height: 30 cm



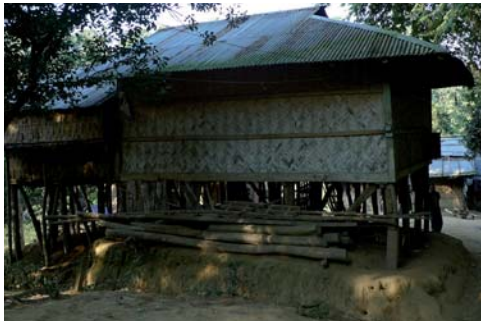
Degradation of the posts due to insects and water

Great number of posts used (stiffening of the structure)

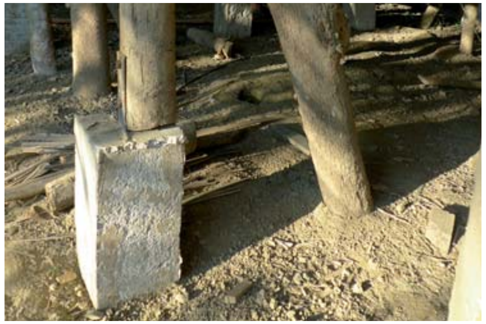
Drainage and empty bags to reduce erosion by water



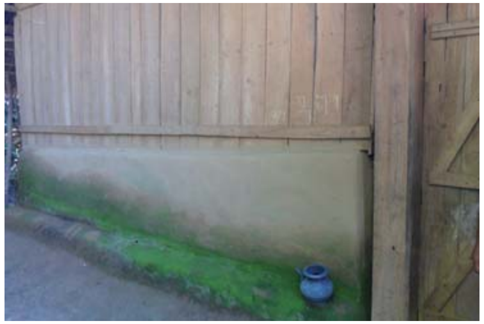
Steps reinforcement with wooden/ bamboo planks



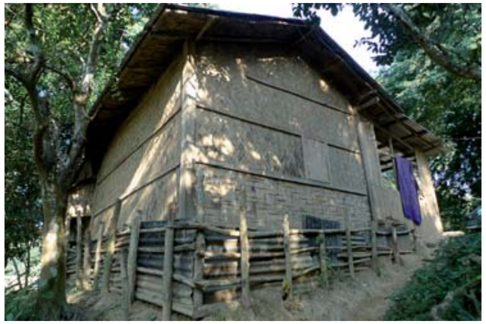
mud plinth to elevate the post base (protection from floods)



Rarely, locally manufactured concrete base is used (protection against water and insects)



Degradation due to moisture, erosion by water, lack of maintenance, insects and rats



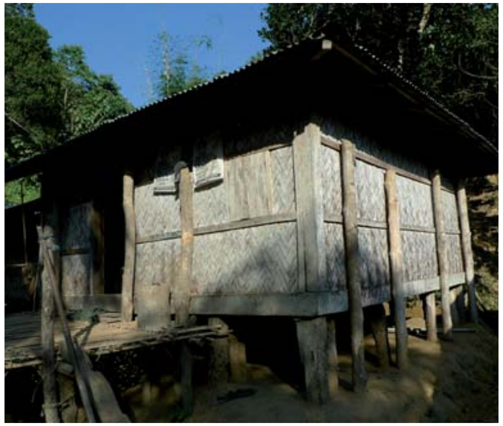
Construction on sloping land: a part of the house rests on infill (no soil stabilization)

construction features

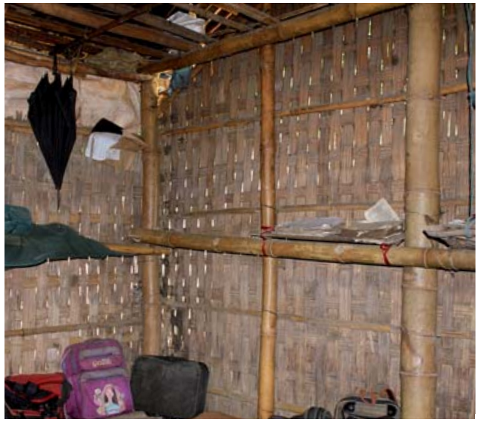
LOAD BEARING STRUCTURE

Machan house

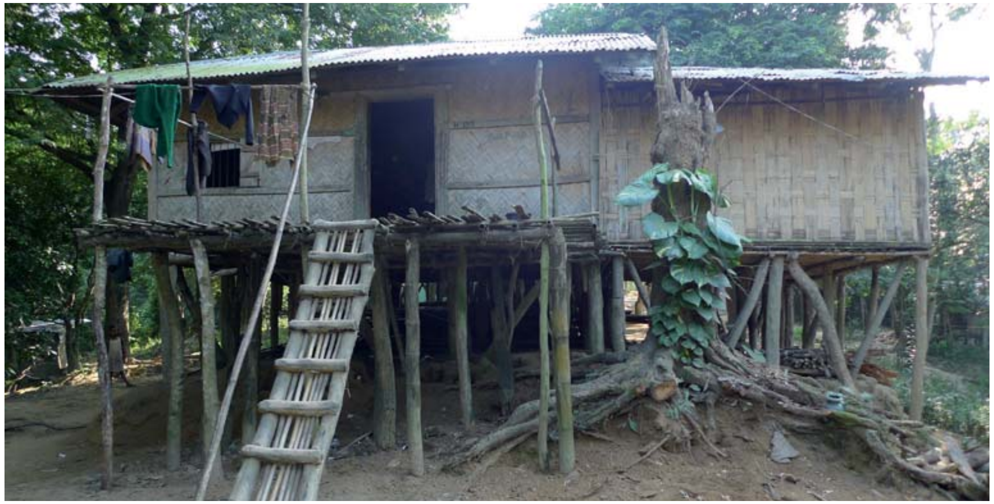
- Vertical wooden posts from the ground to the roof level
- Secondary wooden/bamboo posts from floor to ceiling level
- Horizontal wooden or bamboo beams
- Under the platform, the primary structure is braced by three diagonal wooden elements
- Floor with wooden planks on wooden beams, or woven bamboo strips on bamboo beams

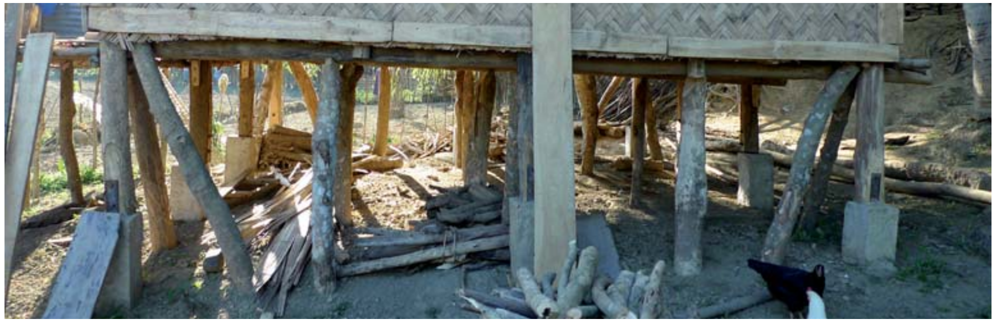


Sometimes the building is reinforced with outer posts to prevent bending due to strong winds



No bracing is used. Horizontal elements for bamboo fences allow for some stiffness of the wall.





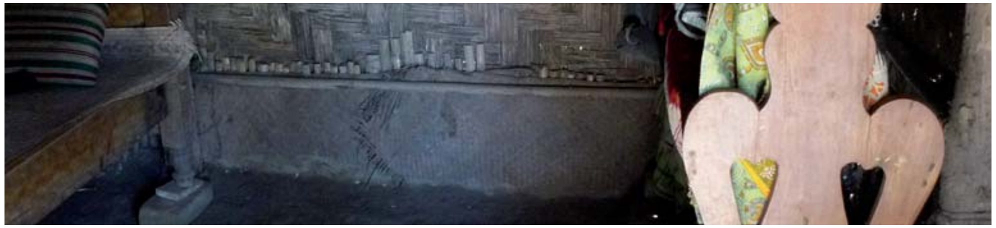
In recent constructions, the number of bracing under the platform has been reduced to two elements due to the high price of wood

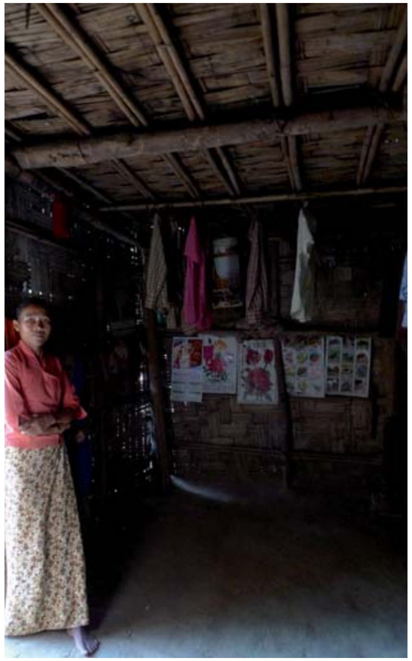
construction features

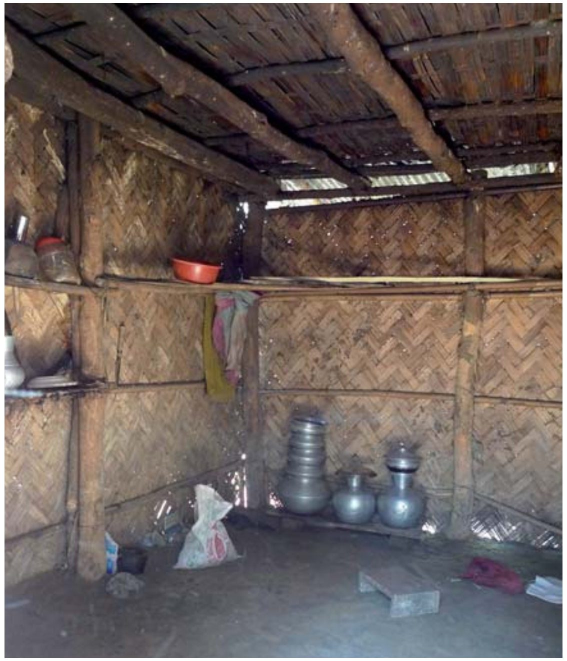
LOAD BEARING STRUCTURE

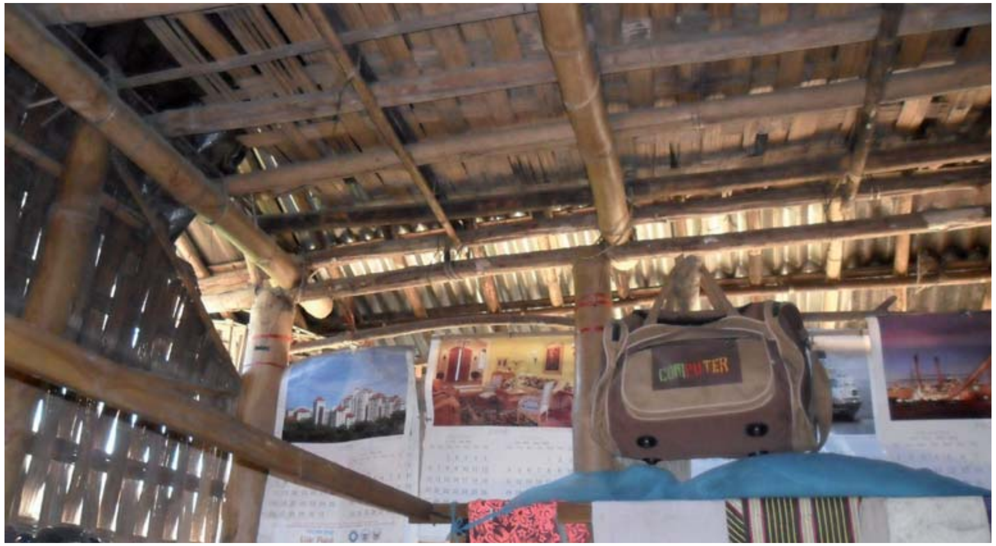
Plinth house

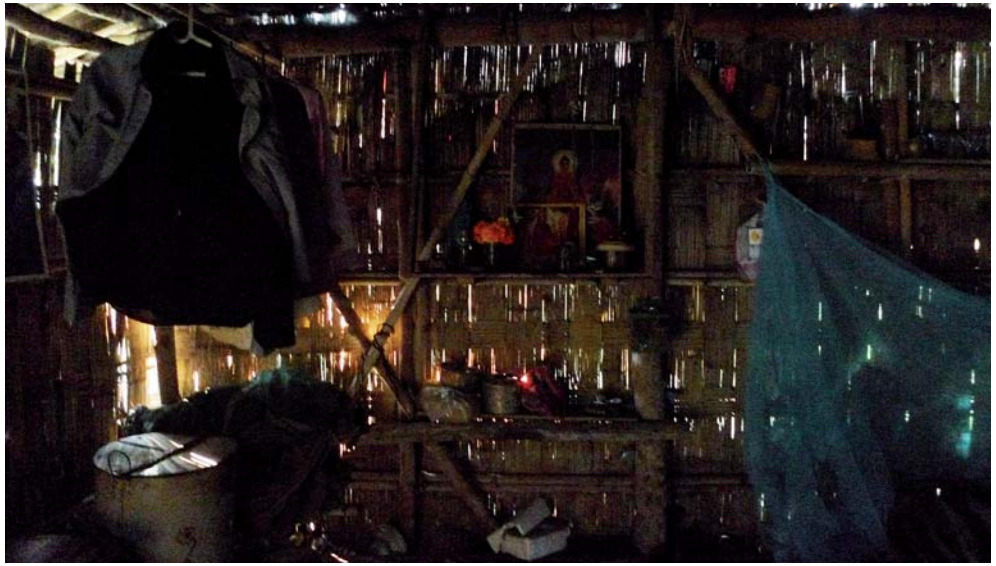
- Wooden or bamboo posts directly into the ground
- Wooden or bamboo beams
- Rarely, wooden posts are fixed on concrete bases









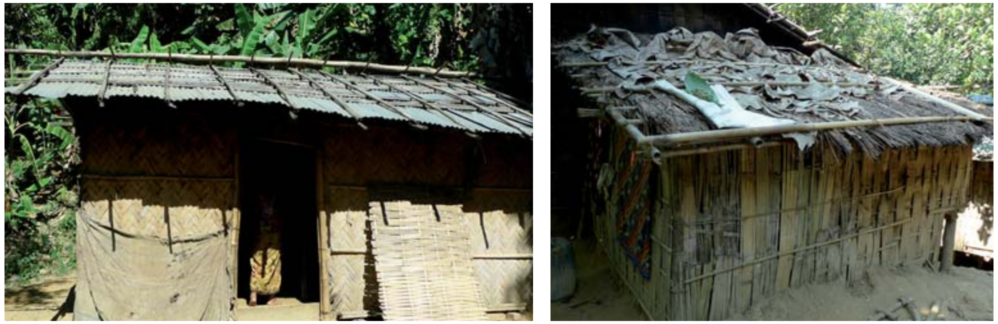


No bracing is generally employed. Horizontal elements for bamboo fences allow for some stiffness of the wall (only one case is known of bamboo structure X bracing for walls perpendicular to wind direction)

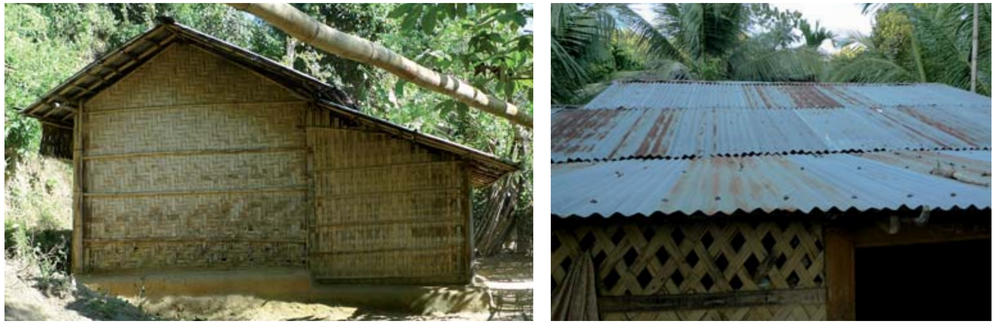
construction features

ROOFING

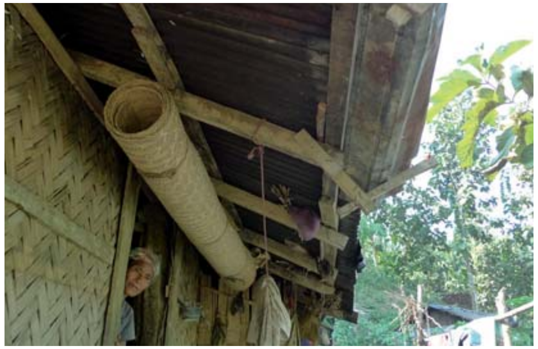
- 2, 3, 4 slopes roof
- Beams, rafters and purlins in wood or bamboo
- Wooden king post
- At both ends of the roof (in plinth house also in the middle of the house), ridge beam is supported by primary structure wooden or bamboo posts
- Eaves: 70-90cm
- CGI sheets or thatch (rice grass) for roof covering
- Sometimes a plastic sheet is placed between thatched roof and battens for better protection against water and insects
- The beam supporting the king post is doubled in traditional dwellings (the number of beams should be odd)
- Kitchen roof is generally independent and lower than the main house roof
- CGI sheets overlaping not sufficient (only one corrugation) ; wrong nails position (on the lower corrugation) ; poor quality of CGI sheet (small thickness)



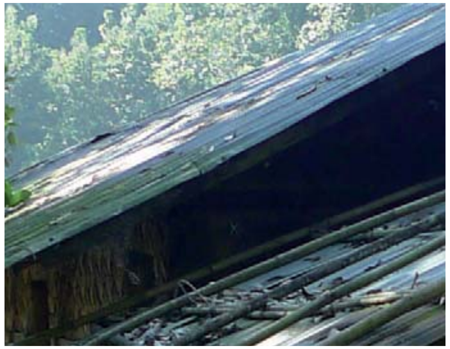
Bamboo slats prevent the roof covering to be blown off



Veranda roof structure is indipendent from house roof structure



Sometimes, wooden elements added to rafter allow fixing a gutter for water harvesting during rainy season

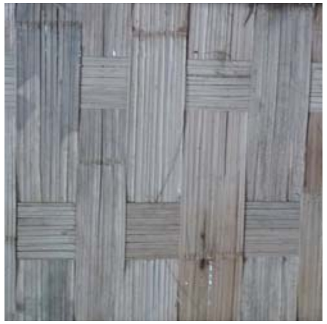


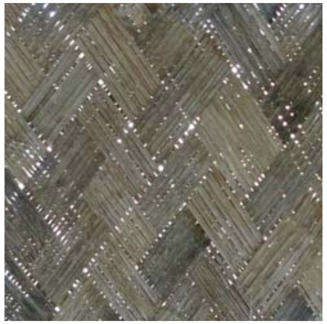
The first and the last CGI sheet are folded and nailed on the side rafters, to avoid blown off

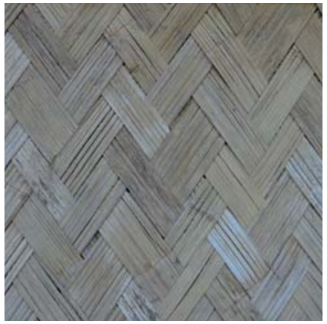
construction features

FENCES

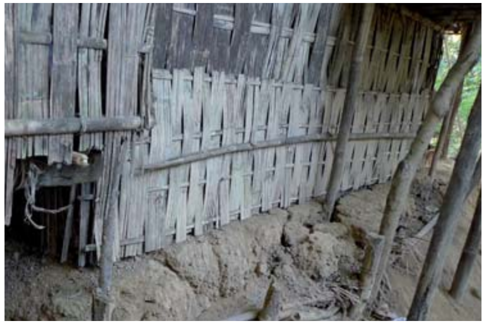
- Generally external and internal walls are made by bamboo woven fences, rarely wooden planks are used for external walls
- CGI sheet is not used for fences, due to its poor thermal (hot and cold) and acoustic insulation
- Walls are not plastered
- For Machan houses, interior partitions are usually placed at least 18-20cm away from the central post
- Bamboo woven fences : 3 different types are generally used:
  - simple layer: perpendicular weaving, easy to produce and low cost, mainly used for internal partitions or kitchen because less resistant;
  - double layer: diagonal weaving, more resistant but more expensive;
  - triple layer: diagonal weaving, ensure a better protection from wind and cold penetration, specific know-how is needed
- Exterior fences are often damaged by water upto 60cm
- Sometimes, during rainy season, polyethylene and rarely CGI sheets are used to cover the bottom part of the external walls as protection from water (floods and rain)







Sometimes the lower part of the outer wall is built with brick masonry upto maximum 70-90cm



To reduce maintenance cost, the damaged part at the bottom of bamboo fences is cut and replaced with a removable part

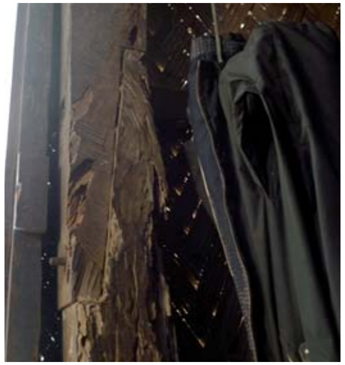
If simple layer bamboo fences are used for outer walls, the slats are vertically oriented to facilitate the water flow

A cow dung stabilized mud plaster is used only for tobacco store building to avoid air penetration

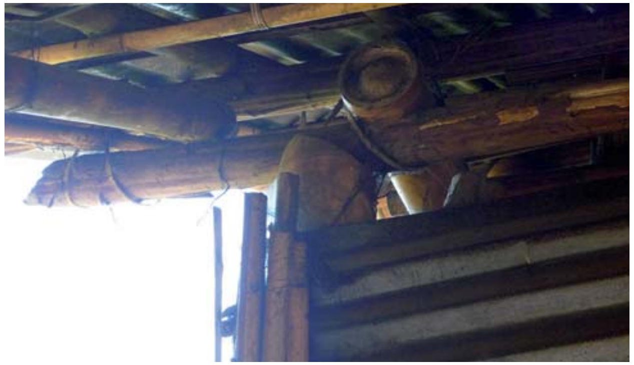
construction features

JOINTS

- Notches and pegs
- Metal connections: nails, metal rods with bolts
- Bonding: bamboo ropes (to be changed every 3 years but easy to produce and cheap), plastic rope (easy to cut and deteriorating if in contact with water), metal wire (expensive and deteriotating if exposed to water)



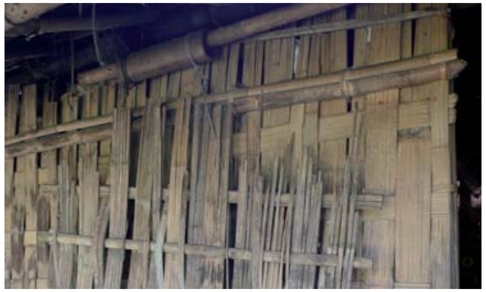
To extend the length of the wooden posts, special joints are sometimes used



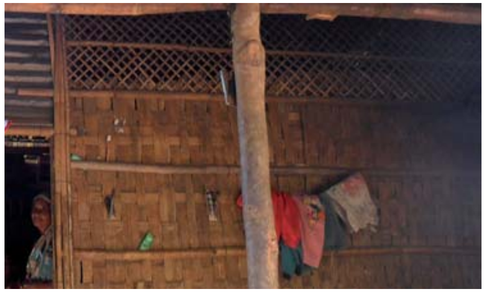
Bamboo culms are usually cut at diaphragm level. This increases the resistance of the culm and its protection against moisture and insects

OPENINGS

- Generally, only a small window exists in the house and it is placed in the main room
- There is apparently no defined rules on the number and location of openings, but the number and size of the openings are limited to reduce costs and to protect from wind and light
- Ventilation and lighting of the rooms are quite poor, mainly through the spaces between the slats of the external wall panels
- Sometimes in Machan houses, a small window at floor level is added for night ventilation
- Windows and doors have wooden frames for better lasting
- The doors inside the house are replaced by curtains, which allow for better ventilation



For bamboo structures, the main door is often a sliding bamboo, to optimize space and materials (no hinges are needed)

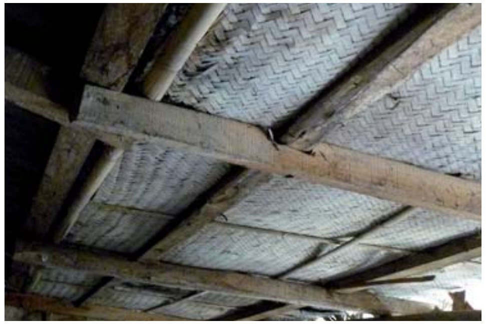


In the upper part of the internal and veranda partitions, bamboo grids allow for ventilation between rooms

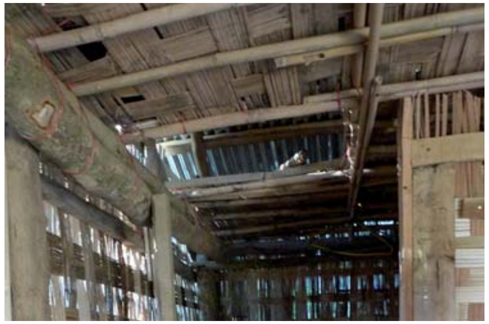
construction features

CEILING

- All houses have a ceiling made with bamboo fences
- Two types of ceiling:
  - horizontal fences resting on the top of the posts, on the main beams and on a secondary structure; system used for the main rooms ; the space under the roof is used for storage and is accessible through a trap
  - between CGI sheets covering and rafters; mainly used for the kitchen



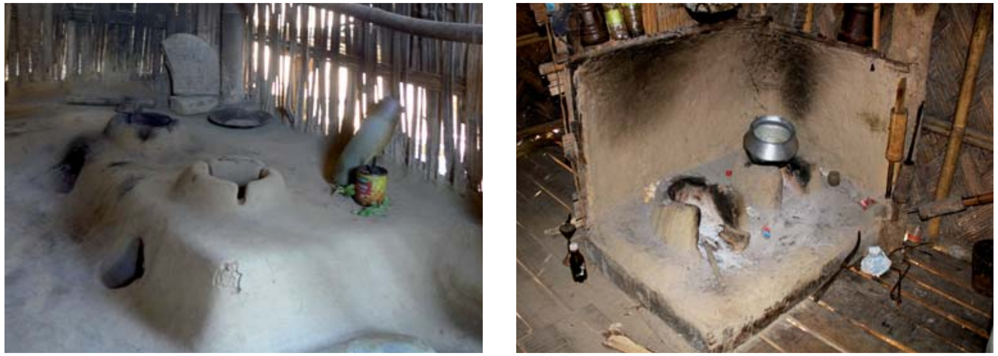
Bamboo fences placed directly under the roof covering improve thermal and acoustic comfort



The horizontal ceiling type provides better thermal and acoustic insulation

OTHERS

Kitchen
- Usually placed in a separate room, the kitchen can also be temporarily placed on the terrace or in the veranda
- Stoves are in mud and placed on the ground
- Wood or wooden sticks covered with cow dung are used to cook



Around and under the stoves a thick mud plaster (about 3cm) is applied to reduce the risk of fire propagation

Shelves
- In Machan house, the use of hanging shelves to store items allow to optimize space in the kitchen and sometimes also in the room.
- In the kitchen, the space between the slats allows air to enter to dry plates and pans

building process

Due to the increasing number of families, there is a shortage of land suitable for construction. So that people enlarge the available building zone by digging the hill. If the nature of the soil or the financial capacities do not allow it, long posts are used to to adjust the housing level. People are aware that digging the hill can cause landslides or rock falls on the houses, but the use of longer posts is very expensive and the roof is also more exposed to wind.

Site selection and house planning are done on the basis of a mutual agreement between the family members.
To decide the type of structure and the materials to be used, the house owner discusses with an artisan: the owner explains the house plan and the artisan suggests the structure to be used. Sometimes the choice of materials is determined by the financial capacity of the owner.
Before starting the construction, the owner defines the main facade, the place of future extensions and the first post position. The latter has to be set up in the middle of a short side of the house.
The construction of the house is done with the help of a skilled carpenter.

The materials are collected little by little and transported by rickshaw or by foot to the construction site.

Women are involved in the production and repair of bamboo fences.

Construction season: from November to March (dry season, availability of materials and period free from agricoltural works).

Duration of construction: 1 to 1½ months
Once materials have been collected, 7 to 10 days with 4 to 6 persons are needed to accomplish the house.
It takes about one month to collect all the materials and construction works may begin before having finished the material collection.

To reduce the cost of construction:
- often the artisans are engaged only for the main structure and / or for the roof
- the owner and his family members are involved in the construction works by helping the artisans and carrying the materials
- sometimes the owner builds the house by himself without the help of any artisan

maintenance

The lifespan of a house is usually 10-20 years, but normally after 2-3 years it has been built, repairing of some parts is needed.
After minimum 10 years and maximum 50 years, the houses are dismantled and completely rebuilt, reusing the materials that are not damaged.

Bamboo fences:
Normally, after 3-7 years bamboo fences are damaged at the bottom part due to rain. The lower part of the fence is cut and replaced or doubled with an additional one on the outer side (more aesthetic and more resistant). This part is completely or partially changed every 1-2 years.
The exterior fences last about 10-20 years without treatment.

Wooden posts:
- fixed directly into the ground: last 15-20 years, according to post dimension and wood ages
- on RCC base: last 50 years

CGI sheets (for roof covering) : last 15-20 years

Thatch: to be changed every year

Mud plinth: every 3-4 days a mud barbotine is applied by women.

In 2007 CB-Chittagong realized two houses after a landslide. It was a non participatory project, but based on the use of local materials and typologies. The houses are in very poor condition due to lack of treatment for the used material and lack of maintenance by the inhabitants. No improvement was made to reduce exposure to possible landslides.

building materials

Bamboo

Types:

- Muli : dia 4-5cm, wall thickness 0.5cm; used for bambo fences; flowered in 2007
- Borak : dia 10cm, wall thickness 2 cm ; used for the main structure; unknown flowering period

Availability:
Before flowering of bamboo Muli: a forest for housing construction or repairing purpose was collectively managed.
After 2007, there is a shortage of Muli bamboo because of the flowering and the price increase due to the presence of a paper mill using bamboo.
Provenance: private plantations, purchased on the local market or harvested in a governmental forest quite far from the village.

Treatment:
Often no treatment is done (if a good quality of bamboo is used, it lasts 20 years).
Cutting period: from November to February with full moon.
Soaking of the bamboo culms in water (15-20 days) and drying in the sun (3-4 days).
Sometimes bamboo is treated with tar (alkatran) or crude oil (maitta oil); bamboo treated with tar can lasts 8-20 years depending on its exposure to water.

Lack of plantation maintenance (reduction in the growth of culms and increase in the risk of snakes)

Flowering: every 30-40 years with death of the bamboos; availability of new shoots after 3-4 years

Wood

Species: guda, dharmara, gutguitta, jarul, gamari, lali

Availability:
private land, governmental forest, local market

Treatment:
Cutting period: from November to February
Soaking in water (from 15 days to 1 year) and drying in the sun (3-7 days).
Sometimes treatment with tar.

Mud

Proveance: building site or hill slopes.
Type of soil: silty
Technique: cob by 15cm layers
Stabilizer: cow dung (not used by Muslims)

Joints

Metal elements and plastic ropes are purchased on the local market, while the bamboo ropes are locally manufactured.

skills for construction

Artisans

Skilled carpenters:	4 (1 trained at the CB-CTG Training Centre)
Semi-skilled masons:	3
Carpenter helpers:	nearly 1 per family
Other:	1 person trained by the Forest Department for wood treatment

Artisans work on seasonal basis.

Generally, artisans learn by practicing with more experienced artisans.
A CB-CGT training center exists in Bandarban town (training for wood and metal works).

Artisans usually do informal follow up of the built constructions (they are not engaged by the house owners to do it).
They discuss with other artisans and they suggest to the owner the improvement and repairing to be done. Sometimes owner do them by himself, sometimes he engages the same artisan that built the house.

Labour cost

Carpenter:	500 – 600 BDT/day
Carpenter helper:	350 BDT/day
Skilled labour:	120 BDT/day
Daily labour:	400 BDT/day

Construction cost

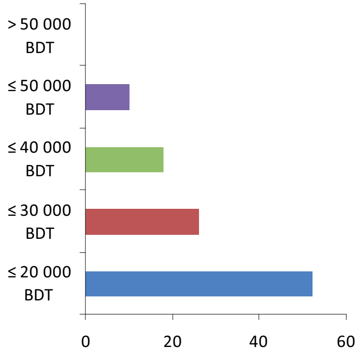
for a medium size house (4.5x5.4m)

Materials:	about 22000 BDT
Labour:	Machan house: 25000-27000 BDT Plinth house: 30000 BDT

Most expensive part:

- Machan house:	floor/platform structure
- Plinth house:	CGI sheets roof covering

If wood is used for:	- floor/platform structure: +1lakh BDT - roof structure: + 70 000-80 000 BDT



Costs of existing houses

first elements for pilot houses design

ELEMENTS TO CONSIDER

Architectural typologies

- 3 pilot house types according to local typologies (traditional houses: machan hosue and plinth house; Bengali plinth house)
- dimensions by housing types:

Machan house:		5.4 x4.5m + 2.4m (terrace)
Plinth house:		
	Traditional type:	5.4x4.5m + 1.8cm (veranda)
	Bengali type:	5.4x3.5m + 1.8m (veranda)

Construction features

Foundations/plinth

Machan (platform) house:
- wooden posts on RCC bases (height more than 30cm or according to local flood level)
- stairs to be improved
- space under the platform to be improved for easier use
- number and size of posts may be reduced

Plinth house:
- double steps mud plinth
- height of the mud plinth above normal flood level
- Protection from erosion by water
- RCC bases for posts

Load bearing structure

Machan (platform) house:
- number and size of posts may be reduced
- wooden main structure + bamboo secondary posts
- bracing

Plinth house:
- wooden or bamboo structure according to beneficiary choice
- number and size of posts may be reduced
- bracing

Roof
- 4 slopes roof
- bamboo or wooden structure
- wooden purlins
- explanations about the right overlapping of CGI sheets and the right position where to put nails on CI sheet are needed
- dimensions of the eaves and roof pitch in order to protect the rain without increasing vulnerability to wind
- permanent or temporary system for rainwater harvesting

Fences
- outer walls: double or triple layer bamboo fences
- inner walls: simple layer bamboo fences with ventilation grid in the upper part
- bottom part of the outer bamboo fences made as a separated piece to allow for easier and less expensive repairing
- improvement for thermal insulation

Joints
- improvement of existing know-how
- bamboo ropes for connections among secondary parts

Openings
- 2 windows (windows number and position to be discussed with the beneficiaries)
- wooden frames for doors and windows

Ceiling
- horizontal bamboo fence ceiling type allowing for storage and thermal insulation
- if not too costly, bamboo fences between rafters and roof covering to improve thermal insulation

Kitchen
- increased mud plastered area around the stoves to improve fire protection
- improved oven or smoke evacuation system

Shelves
- integration of traditional shelves to pilote houses based on traditional housing types

first elements for pilot houses design

Materials

Bamboo

- Implementation of community bamboo plantation for construction purpose (to be discussed with the community)
- training for improved management of plantation
- Slope stabilization with new plantations
- long lasting treatment: borax and boric acid (to be checked according to local availability of materials)

Wood

- Traditional or improved treament
- Implementation of community and/or private tree plantation for construction purpose (to be discussed with the community)

Skills

- training for double and triple layers bamboo fences production

Cost

- budget : 40000 - 60000 BDT (400-600 €) per house

maintenance

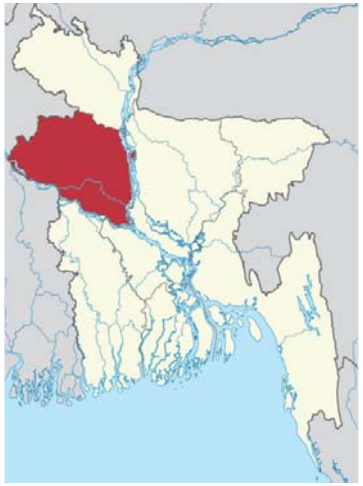
- Awareness about the importance and the different methods of maintenance
- Intensive follow up by CB about the maintenance of pilot houses and their surroundings

Collaboration

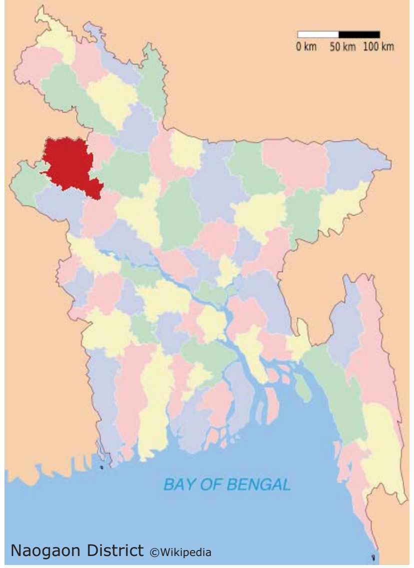
- Collaboration with other NGOs and government departments working in the area for complementary activities

region 2

Rajshahi Division_Naogaon District



context



Naogaon District ©Wikipedia

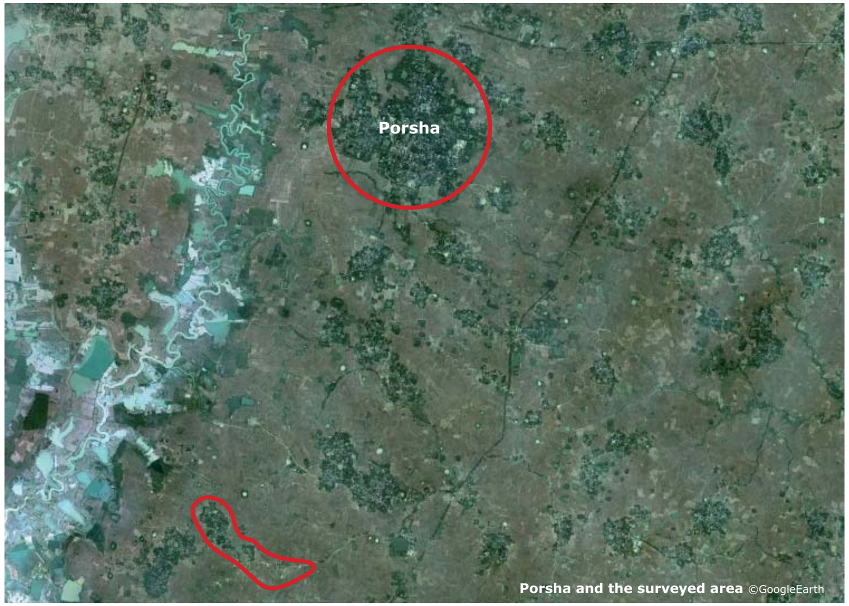
SOCIO-ECONOMIC PROFILE

Population

- Communities:
  Bengali
  Adivasi (Sawtal, Urao, Mali, Pahan)
- The most of the people emigrated from other villages
- 18 families are living on gouvernmental land

Main activities

Daily labours for land owner



Porsha and the surveyed area ©GoogleEarth

LOCAL RISKS

Drought

- rain only for 3 months per year (May-July)

High temperature variation

- from 7°C to 45°C

Cold waves

- annual frequency

Storms

- strong winds with heavy rains
- period : April-May
- annual frequency

Floods

very rare (last flood in 1998)

Earthquakes

- medium risk
- frequency : moderate earthquakes, twice per year
  quite strong earthquakes: every 3-5 years
  very strong earthquakes: every 50 years
- No significant damage has been found (cracking of housing walls)
- past events:
  - 2008, 5 July, India Bangladesh border, M 4.1
  - 2011, 18 September, Nepal Sikkim border, M 6.9

site

Upazila	Porsha
Union	Chaor
Ward	3

zone rural

morphology
uneven land

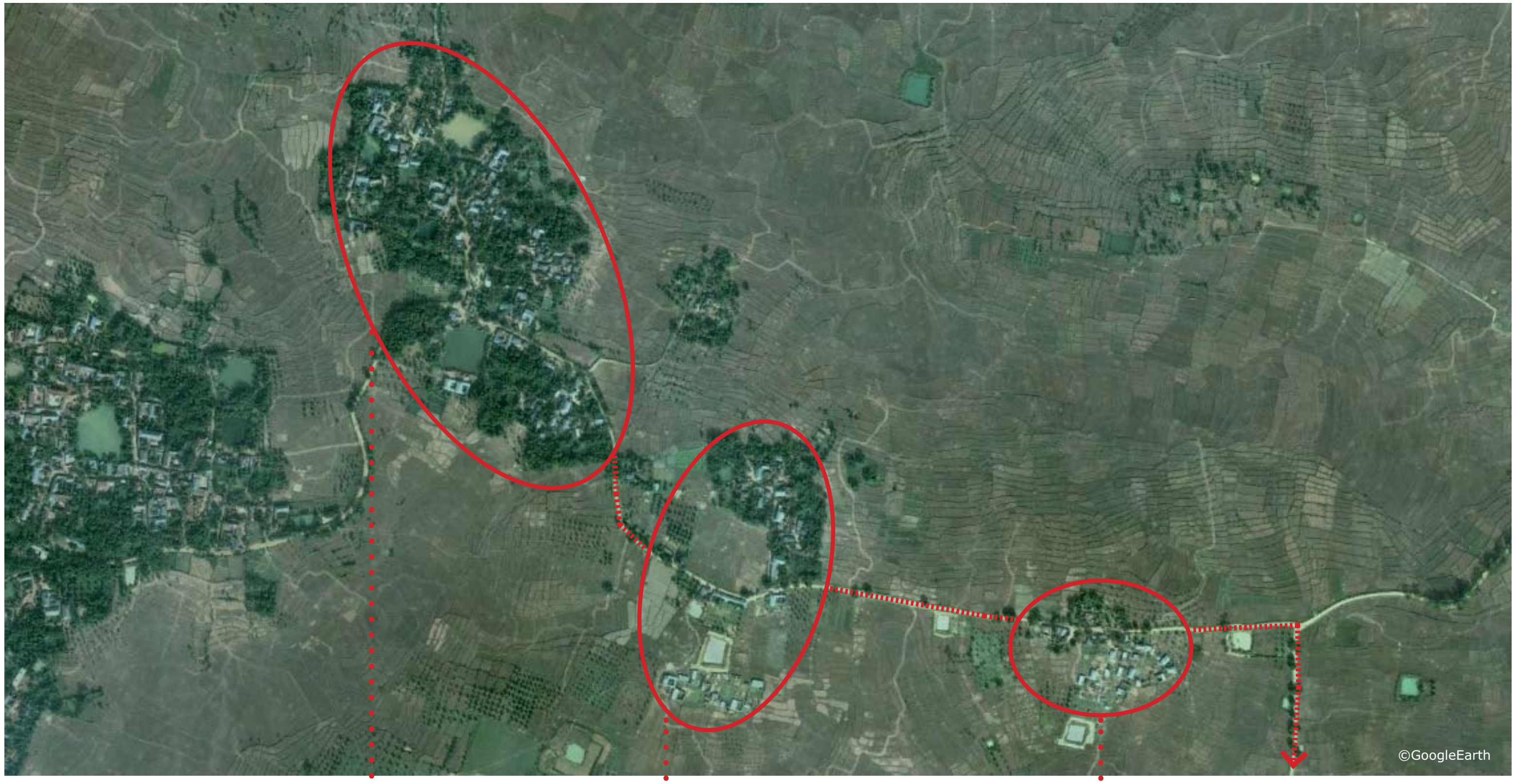
access
15min by car from Porsha

settlement implantation site
raised areas

facilities
none at village level

protection from local risks
strong winds: sometimes bamboo plantations

households 129
enlarged families
family sizes:
- small: 3 p
- medium: 5 p
- large: 8 p



Bashpara
41 houses:
41 earthen load bearing walls
0 bamboo structure
settlement pattern: clustered
access: easy, unpaved road
water sources: 2 ponds

Uchadanga
51 houses:
47 earthen load bearing walls
4 bamboo structure
settlement pattern: clustered
access: easy, unpaved road
water sources: 3 ponds

Hiradanga
37 houses:
32 earthen load bearing walls
5 bamboo structure
settlement pattern: clustered
access: easy, unpaved road
water sources: 1 waterpump, 3 ponds

housing typologies

Two types of housing typologies correspond to two different construction techniques: massive earth construction and bamboo frame.
The adoption of one typology is dictated by the financial capacities of the house owner. The rectangular shape of the plan and the considered space arrangement criteria are the same for both types.

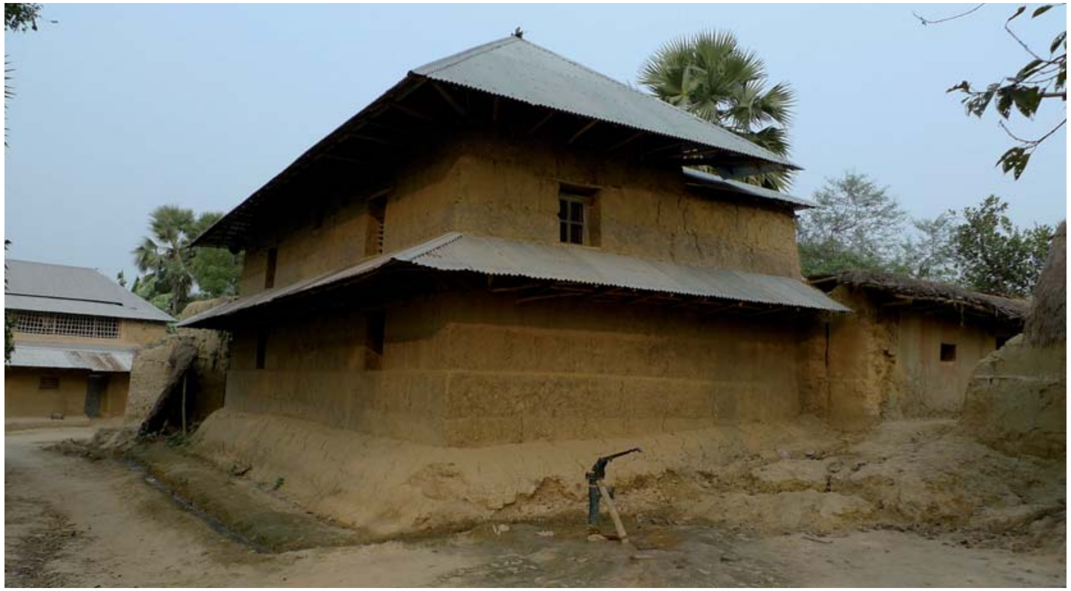
The orientation of the house is generally southwest facing to benefit from the light and a better ventilation.

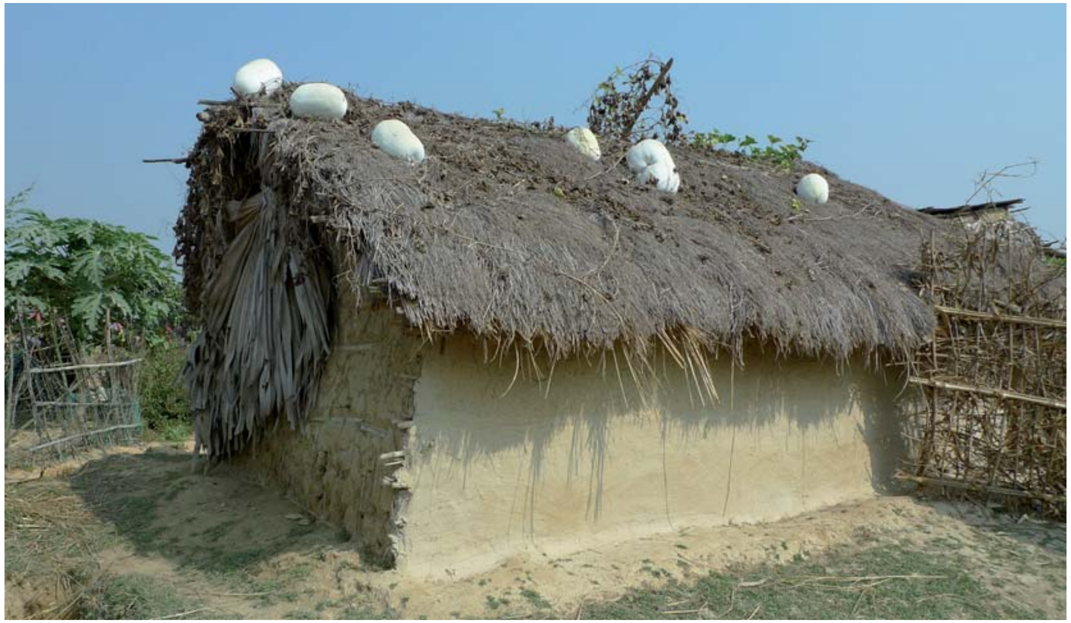
If bamboo frame houses correspond to a single room typology, earthen building are characterized by the presence of at least two rooms.
The entry of the houses is made through an open or closed veranda which in earthen buildings runs along the longest facade, while in bamboo structure buildings is located on the short side.

In most cases, earthen houses are two stories height, with a staircase between the two pieces to access two rooms upstairs or a mezzanine, if the house is not yet complete.
If the house more households are living, rooms and staircase are accessible from outside to preserve privacy. If only one family lives in the house, the staircase is accessible from the two rooms on the ground floor. In big houses, the staircase is placed on one side of the house, connecting the veranda on the ground floor with a balcony upstairs.

Extensions are made in vertical direction, to preserve free space in front of the house and to reduce construction costs.
Stages of construction generally include: two rooms and a stairs at the ground floor, veranda, mezzanine, two rooms upstairs, ceiling of the upstairs rooms and extension of the staircase to the attic.

The animals are kept inside the house to prevent theft and robbery. If the house has only one room, one person of the family sleeps with the animals and someone else outside.





housing typologies

Space arrangement

The living rooms are accessible from the veranda on the ground floor, and from the stairs on the first floor.
The kitchen is placed on a short side of the veranda or outside, if the size of the veranda is too small.

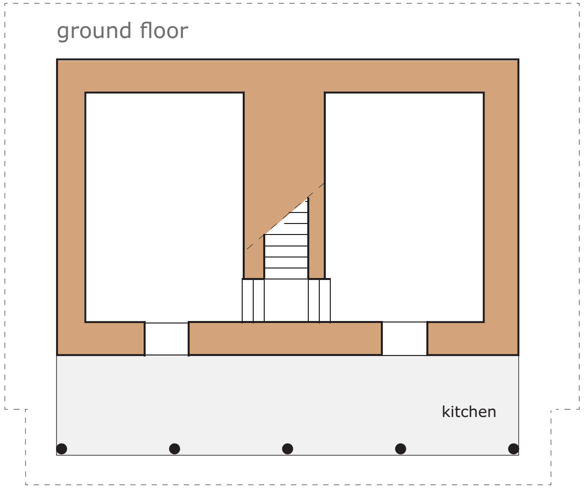
Veranda represents a transitional space between the outside (the street) and the interior of the house.
Sometimes when the parcel is surrounded by earthen walls, the veranda runs along the four sides of the courtyard.
In some cases, the veranda is closed by walls, becoming a corridor serving the rooms, covered by a loggia at the first floor.

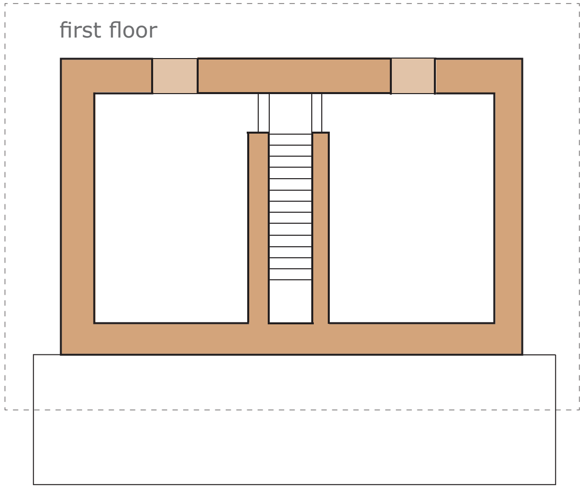
Dimensions

Earthen load bearing walls house

outer perimeter	8.40 x 5.40 m
rooms	7.20 x 4.20 m
veranda	8.40 x 1.80 m
room height	2.40 m

Bamboo structure house	3.0 x 4.5 m



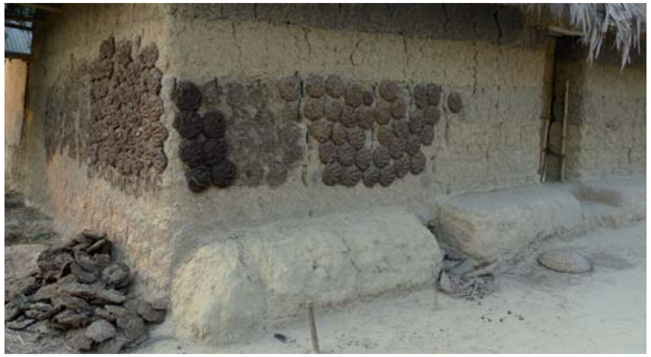


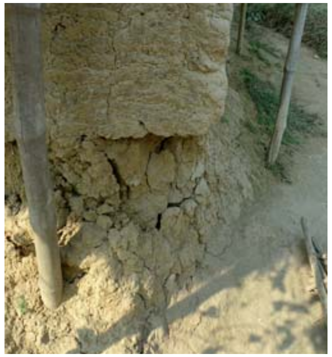
construction features

FOUNDATIONS/PLINTH

Any type of foundation is used.
The plinth is made of compacted mud, after the erection of the walls.
Plinth height: 10-50cm

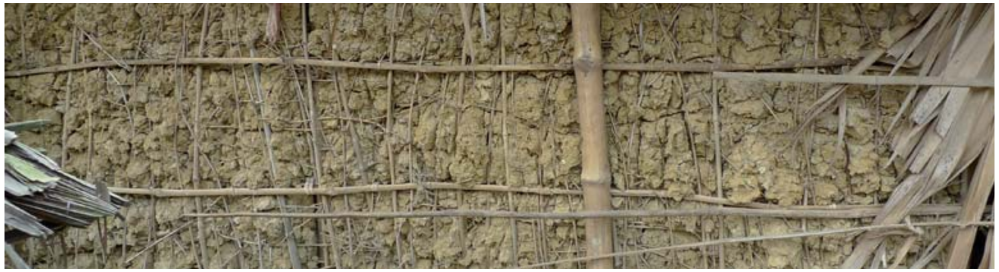
- degradation by water erosion during rainy season and by animals



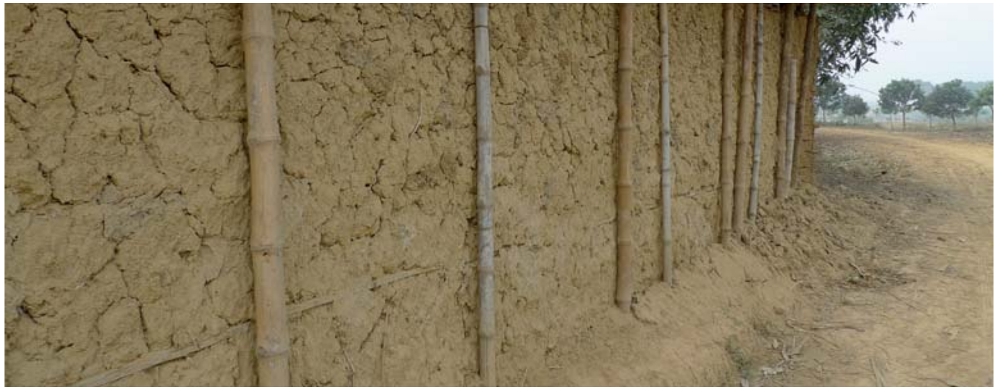


LOAD BEARING STRUCTURE

Bamboo frame
- bamboo posts
- Infill: wattle and daub on bamboo leaves and branches fences
- wall thickness: 15 cm
- wall height: 90-150cm



All the parts of the bamboo are used (culms for main structure, branches and leaves for fences)



After 5-6 years the wall generally collapses due to damage by insects to the fences. Bamboo culms are sometimes used as reinforcement.

construction features

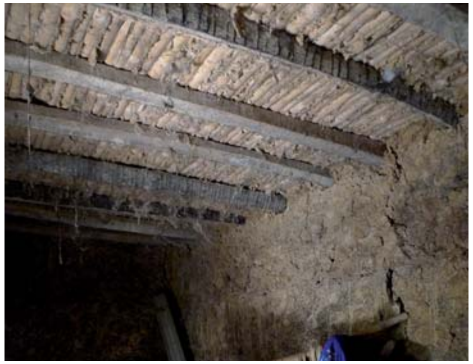
LOAD BEARING STRUCTURE

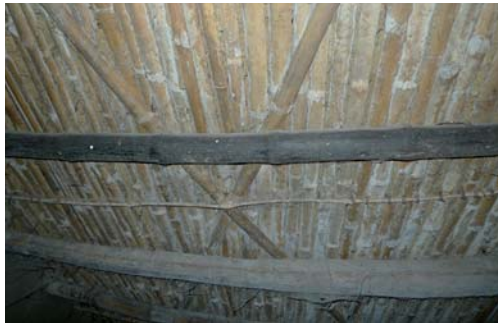
Earthen load bearing walls

- technique: cob
- wall thickness: 90cm at the bottom; 40cm at the top (two storey house)
- layers: 25-50cm
- two storey wall height: 5.40cm
- mud stabilized with (rice or vetiver) straws to avoid cracking
- reduction of the thickness of the walls on the outer side: 3 steps of 3cm of depth every 1.5-1.8m; reduction is not made by molding the wall diagonally because it is more difficult to control the size during the construction
- the thickness of the wall allows for: a better thermal insulation, vertical extensions, a mass capable of resisting to the type of local seismic events

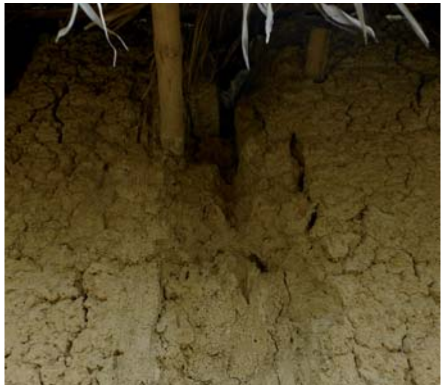
Floor structure:

- bamboo or wooden beams directly fixed in the wall, half bamboo culms or opened bamboo joists, with mud finishing (3cm)
- distance between beams: 50cm
- load capacity: at least 4 tons
- lifetime: more than 10 years

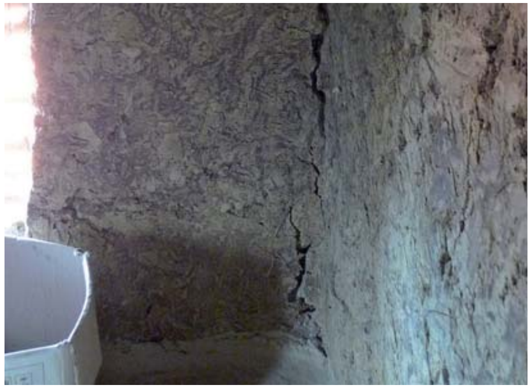




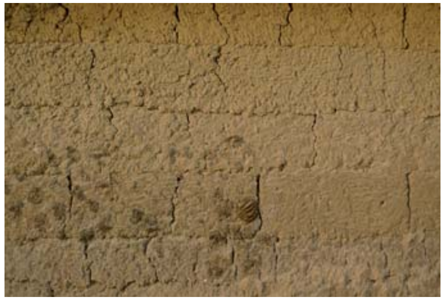
Sometimes floors are diagonally braced



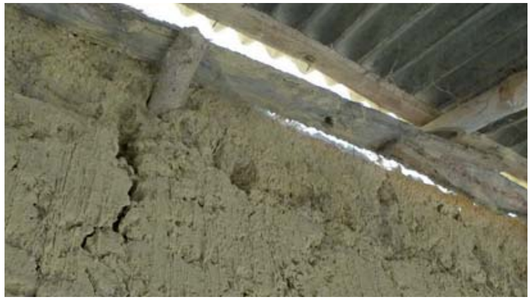
Walls erosion by rainy water (infiltration and/or runoff)



Opening angles due to a lack of connection between perpendicular walls



Shrinkage cracking of the earth during drying



Cracking under beams due to non homogeneous load distribution

construction features

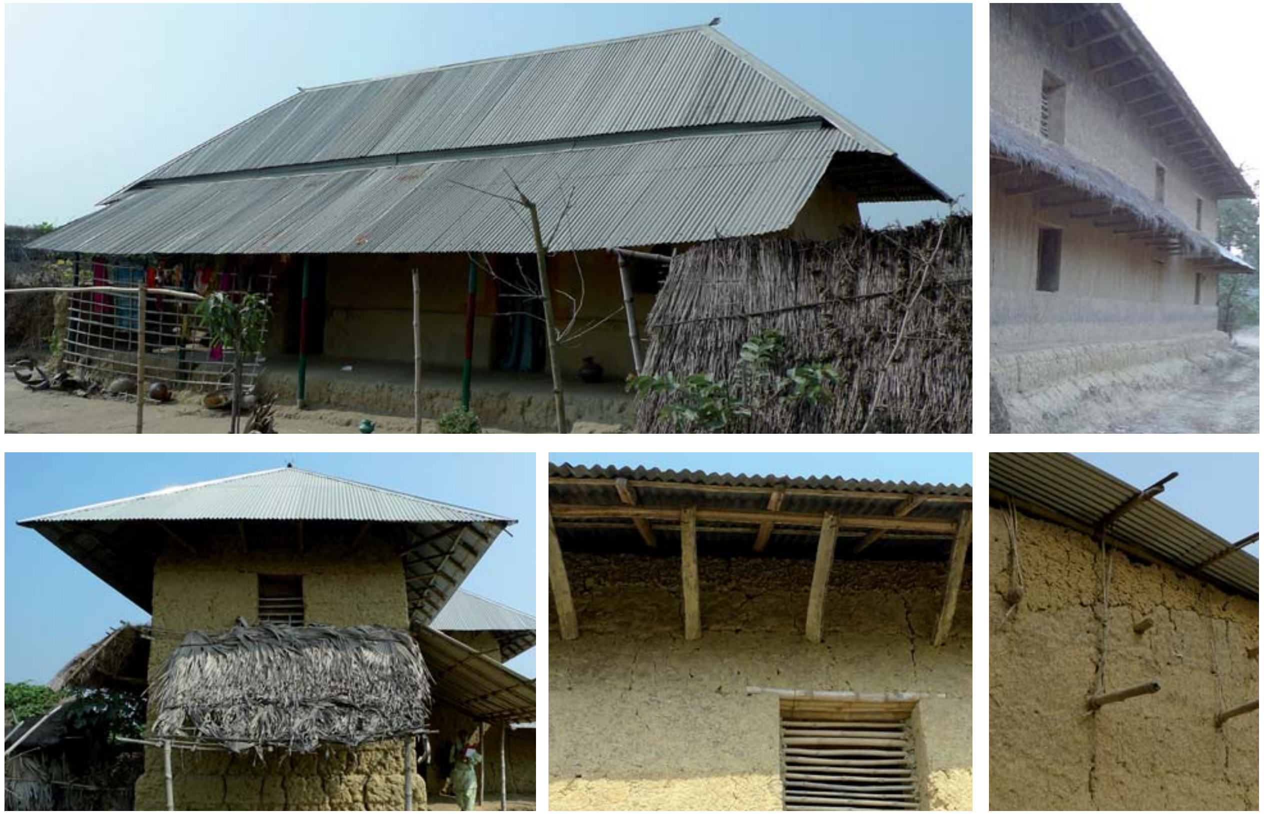
ROOFING

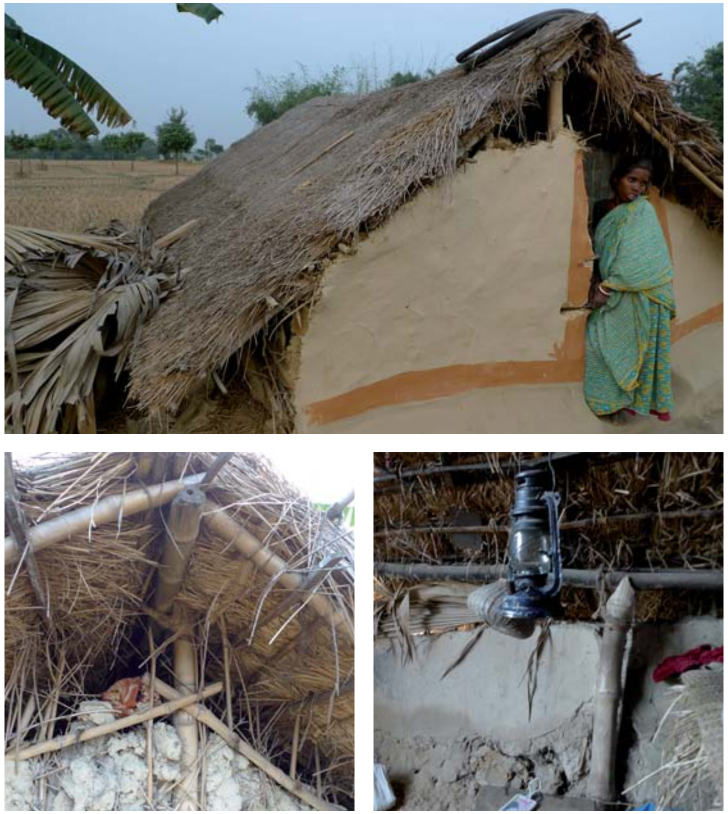
Earthen load bearing walls

- 4 slopes roof or 1 slope roof (if waiting for extension)
- bamboo or wooden cantilever structure
- to avoid blow off of the roof, the structure is fixed by a part wall or by ropes anchoring the rafters to bamboos integrated ino the walls
- eaves: 1-1.5m
- roof covering: CGI sheets, thatch (rice or vetiver)
- when two storey house, an eave placed at the middle height of the wall protects the bottom of the wall

Bamboo structure

- 2 slopes roof
- bamboo structure
- covering: thatch (rice or vetiver)



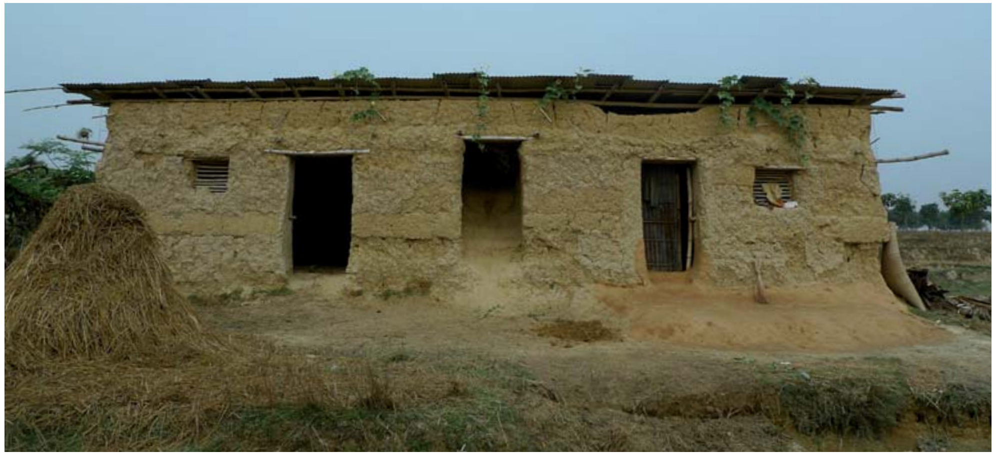


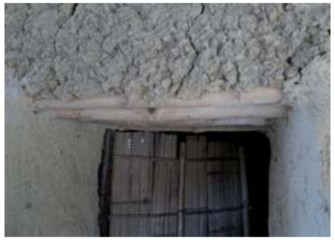
construction features

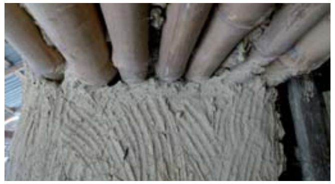
OPENINGS

Earthen load bearing walls
- few and small windows with grid
- bamboo lintels (30cm inside the wall from each side)
- only entrance from the outside have door
- openings are not aligned to ensure privacy inside the house

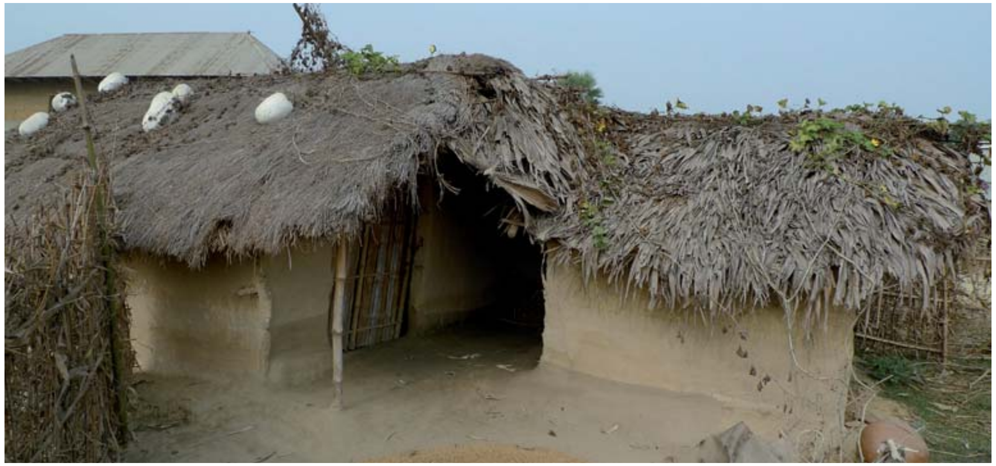
Bamboo structure
- no windows
- only one entrance door







Degradation of lintels doesn't affect the stability of upper wall



Poor lighting and ventilation

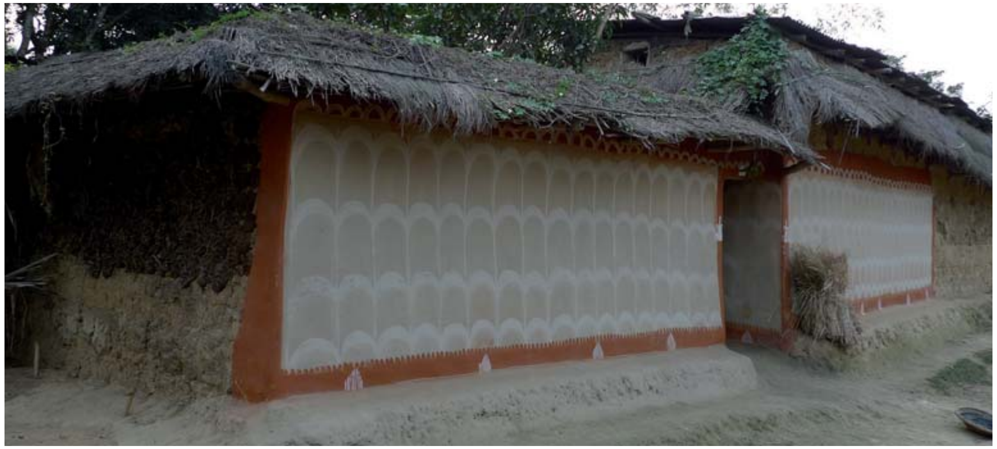
construction features

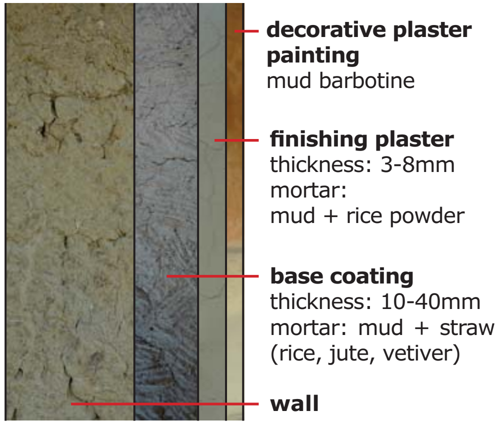
FINISHING

Earthen plasters
- application on interior walls, the main facade and on the ground
- colors:

black:	mud mixed with ashes
red:	mud mixed with powdered brick or other types of soil
white:	silty mud

Sometimes a layer of tar is applied at the bottom of the wall to protect from water (upto 90cm)



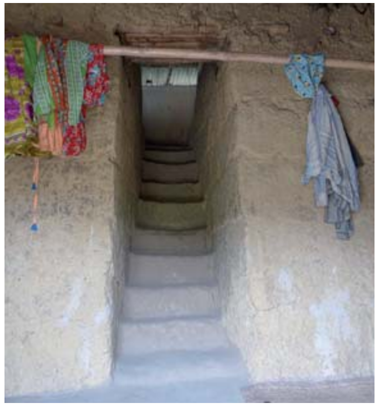
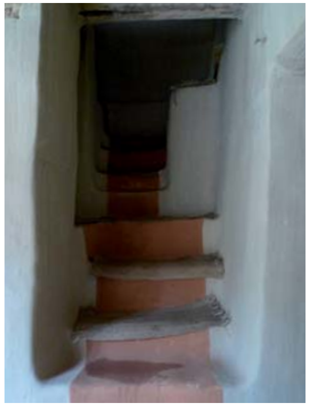
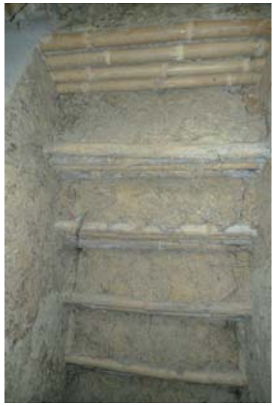
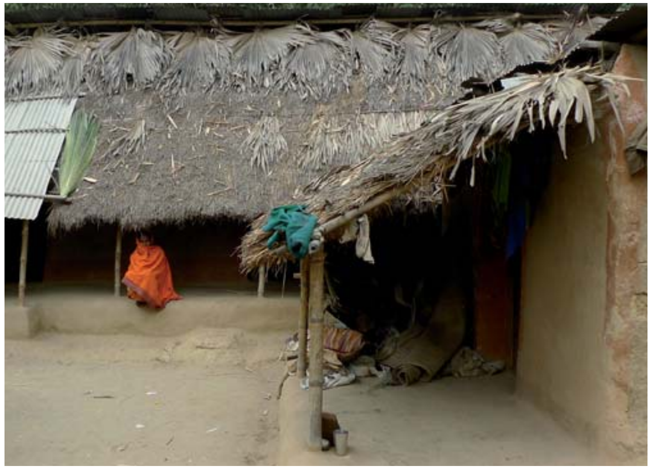
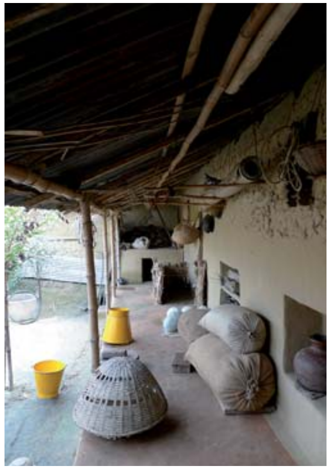
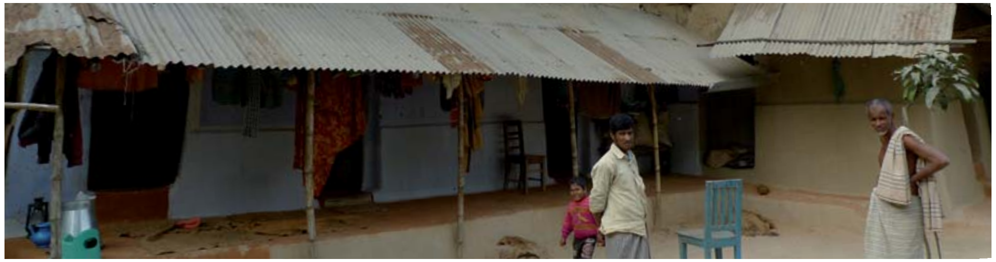


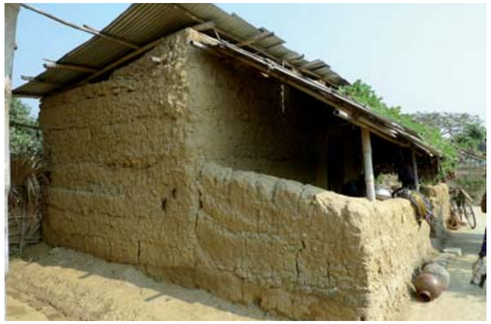
construction features

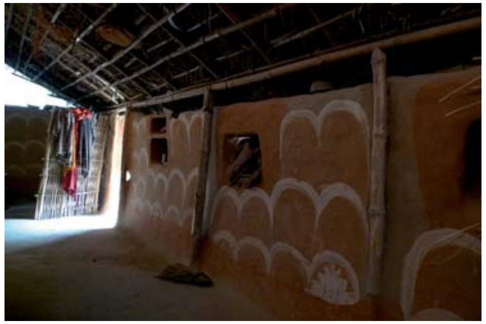
OTHER

Stairs
- height of the steps: 25-30cm
- Between ground floor and first floor, the space under the stairs is filled with mud
- Between first floor and attic: steps are made with bamboo embedded in the walls and a mud finishing

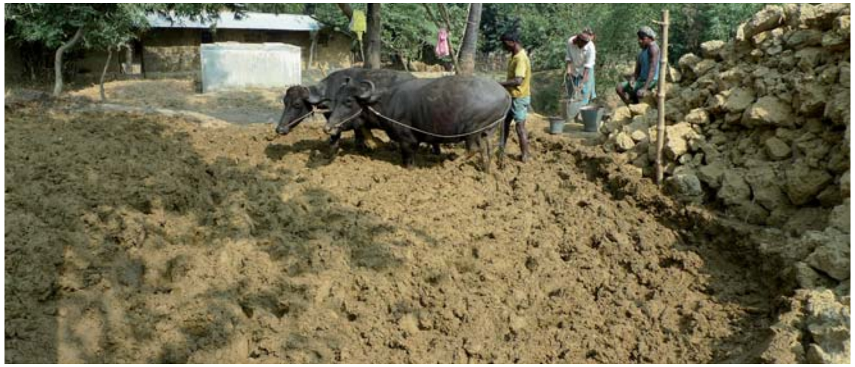
Veranda
- sometimes it is closed on all sides by earthen walls, becoming a real room
- sometimes the roof slopes are very steep to allow faster water run-off; this will alow a longer lasting of the covering material (especially for thatched roof).

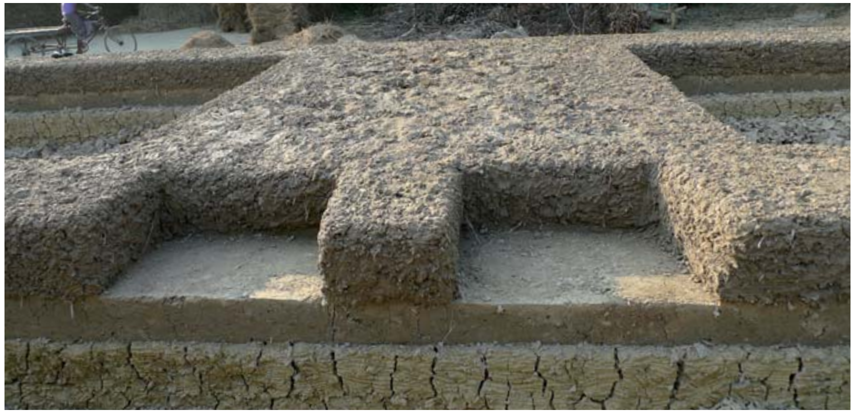







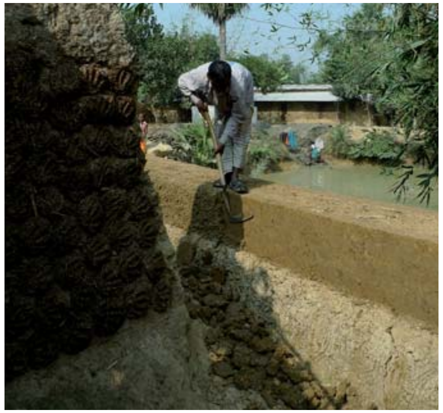


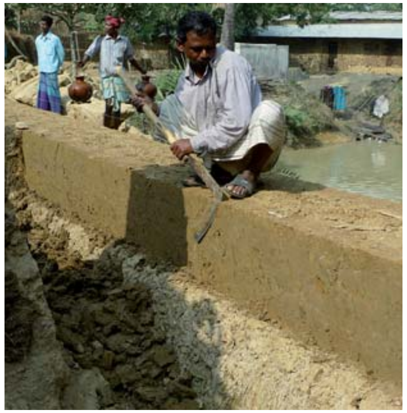


building process









The construction of the house begins with the completion of the ground floor, which usually includes two rooms, a staircase and a veranda. When the owner has the economic means to enlarge the house, the walls are raised vertically.Often a mezzanine is used before the creation of the first floor. Once the first floor slab is completed, the space under the roof begins to be used primarily as storage or sleeping space and then with the rising of the walls, it assumes the appearance and the function of true rooms. Waiting for completion of the first floor and the definitive roof, a temporary single slope roof structure is achieved, often precariously attached to the walls.

Very rarely horizontal extensions are made. In most of the cases, due to the limited size of the plots, there is no space for additional rooms. If the owner needs more space, the house is destroyed and rebuilt at the same location but a little wider than before. In this case, the materials of the previous house are reused.

Thanks to the physical features of earthen material, the walls can be adjusted or extended even after several years.

Construction season: October-March
Duration of construction: 4-5 months with 8 persons

Stages for wall construction:
1 : excavation of a 15-25cm depth trench
2 : compaction of the existing soil in the trench with a pisoir or a piece of wood
3 : leveling of the soil and wetting to facilitate bonding
4 : construction of the wall by layers (layers height 45-55cm, 7-8 workers are needed to do a layer in one day)
5 : after 4-5 days, the wall is cut with a special tool
6 : every 2 weeks a new layer is done

To reduce the cost of construction:
- to reduce the cost of the roof, sometimes roof slopes are steeper to reduce the number of CGI sheets required
- involvement of the owner and family members in the construction:
    - men help in the preparation of the mixture and for the construction of the roof structure
    - women collect the soil and carry the mixture on the building site.

maintenance

Earthen load bearing walls house

Lifespan of the house: more than 100 years

Repairing works generally consist in refilling of cracks and strengthening of the plinth by adding a wear mass of mud, tasks done by women.

Finishing work:
Inner walls: every 3-6 months
Outer walls: every month with a mud barbotine
Floor: every 3-4 days

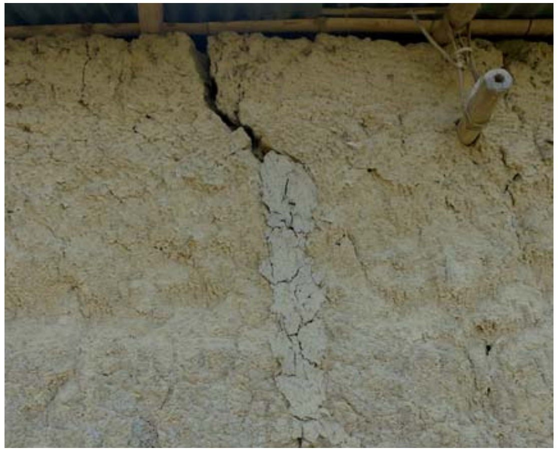
Finishing works and plaster maintenance are generally done by women, but there is also a group of artisans specialized in finishing works.

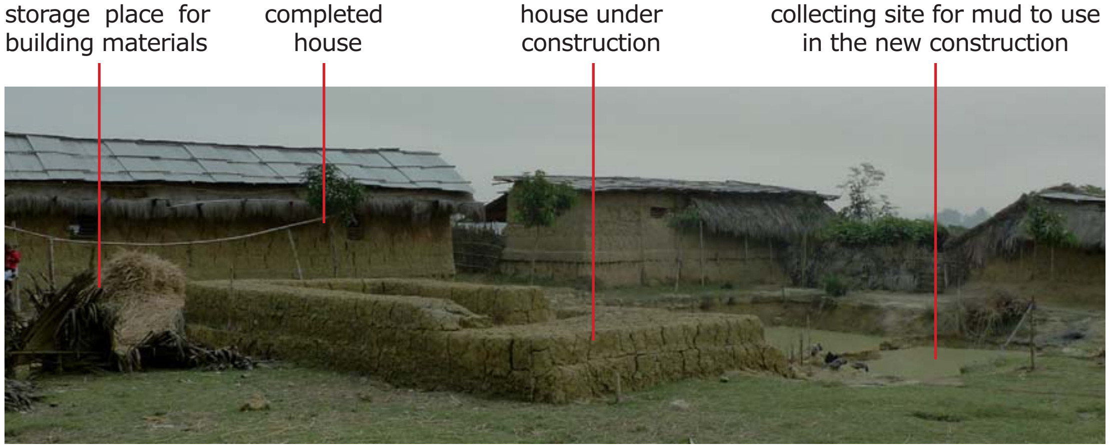
Bamboo structure house

Lifespan of the house: 10 years, if not in contact with water
1 year, if in contact with water (no plinth)

Vetiver roof covering

Every 5 years, damaged purlins and vetiver bundles are changed. The ones still in good conditions are mixed with the news ones.




storage place for building materials
completed house
house under construction
collecting site for mud to use in the new construction

building materials

Mud
Mixture for wall construction:

- mud + straw (vetiver or rice) + powder of rice husks

Mixture preparation:

- mud is mixed with water and kept for 2 days
- straw and rice husks are added
- mixture is mixed using feet or buffalos

Straw and rice powder can attract insects, vetiver is generally preferred.

Vetiver (binna grass)
- lifespan as roof covering material: 3-5 years
- available in October

Water for construction purpose
- water from water pumps
- in drought period, water is purchased from someone (2000BDT for a one storey building)

Carriage
by feet, bicycle, cow cart, cycle rickshaw or votvoti

Wood
Species and use:

- palm trees and neem: roof and floor structure
- mango trees: doors and windows

Treatement:

- drying in the sun
- application of tar or crude oil (protection against insects)
- diesel car oil (less expensive)

Bamboo
- dia: 8cm, wall thickness: 1.5cm
- use of mature bamboo (2-3 years)

Cutting period: March

Treatement:

- drying in a horizontal position (8-15 days)
- soaking in water (10-20 days)
- drying up in the sun (2-3 days)

Provenance of construction materials

Mud	near the construction site or from the fields
Bamboo	private plantations in the villages or purchase from someone
Wood	Murshidpur, local market (2-2.5 km)
Vetiver	village
CGI sheet	subdistrict market (Porsha bazar) 7-8 km

skills for construction

Artisans

Masons for earthen construction:	8
Carpenters (structure):	5
Carpenters (door and windows):	2

Tasks of artisans involved in earthen construction:
Head mason: check the wall line and cut the mud wall
Semi-skilled artisan 1: put the mud on the wall
Semi-skilled artisan 2: bring the mud mixture to the building site

This organisation corresponds to the apprenticeship stages. To become head mason 5-7 years are generally needed.
There are no training centres nearby the village, artisans learn working with a skilled artisan.

Generally artisans don’t do a follow up the new constructions and there is no discussion among artisans concerning construction problems.

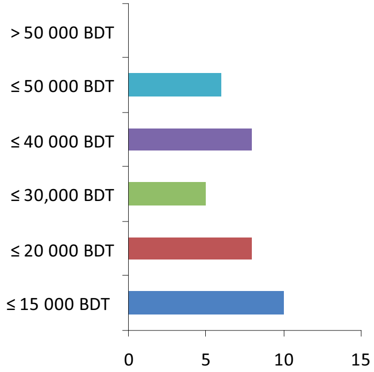
Labour cost

Head mason:	200 BDT/day
Semi-skilled artisan:	150 BDT/day
Non skilled labour:	150 BDT/day (man) 100 BDT/ day (woman)

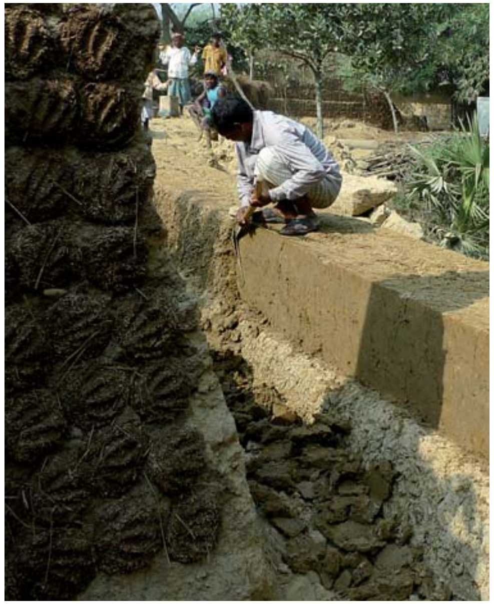
Construction cost
for an earthen load bearing walls two storey and two rooms house including labour (dimensions 3x5.4m,):

8000-9000 BDT (without CGI sheet roof)

100000 BDT (with CGI sheet roof)



Costs of existing houses



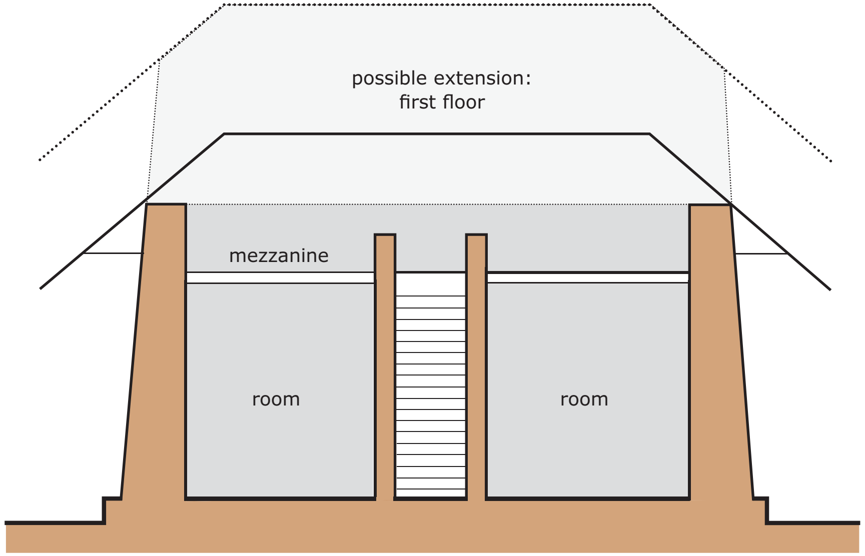
first elements for pilot houses design

ELEMENTS TO CONSIDER

Architectural typologies

2 pilot house types according to local typologies:
- earthen load bearing wall house
- bamboo structure house

Dimensions:
2 rooms (for earthen house: stairs in the middle)
height: 1 storey
dimensions : outer: 8.4x5.4m
earthen type:
room 1: 3x2.4m
room 2: 2.4x2.4
veranda: 8.4x1.8m
room height: 2.4m



Construction features

Foundations/plinth
- mud plinth (height 30cm)
- drainage around the house
- for bamboo structure house: RCC bases for posts

Load bearing structure

Earthen load bearing walls
- mixture stabilized with vetiver or rice straw
- thickness: outer walls: 60cm
  stairs wall (non load bearing): 30cm
- wall plate at the top of the walls and under the beams
- if wall thickness reduction, the following factors should be considered:
  - possibility for future vertical extension
  - thermal insulation
  - earthquake resistance

Bamboo structure
- treatement for all bamboo parts (borax and boric acid)
- improvement of connections (bamboo ropes and metal straps)

Roof
- 4 slopes roof
- mixed wood and bamboo structure with CGI sheets covering
- bamboo structure with vetiver covering

Openings
- 2 windows per room
- rotating shutters (reduction of the materials used for the frame)
- 1 door per room

Mezzanine
- bamboo beams with bamboo woven fences

Veranda
- open
- bamboo structure
- if possible, built by reusing materials from the previous house

Other
- rainwater harvesting system

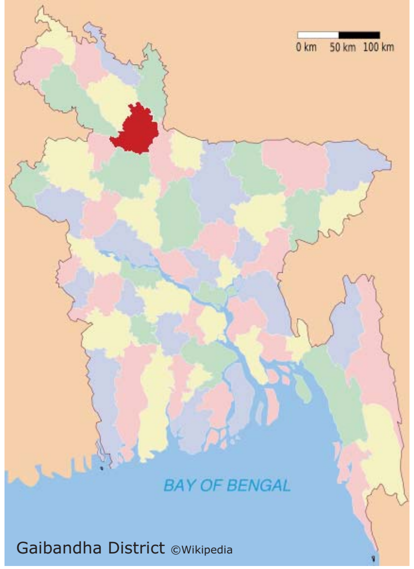
Cost

Budget : 40000-60000 BDT per house

region 3

Dinajpur Division_Gaibandha District

context



Gaibandha District ©Wikipedia

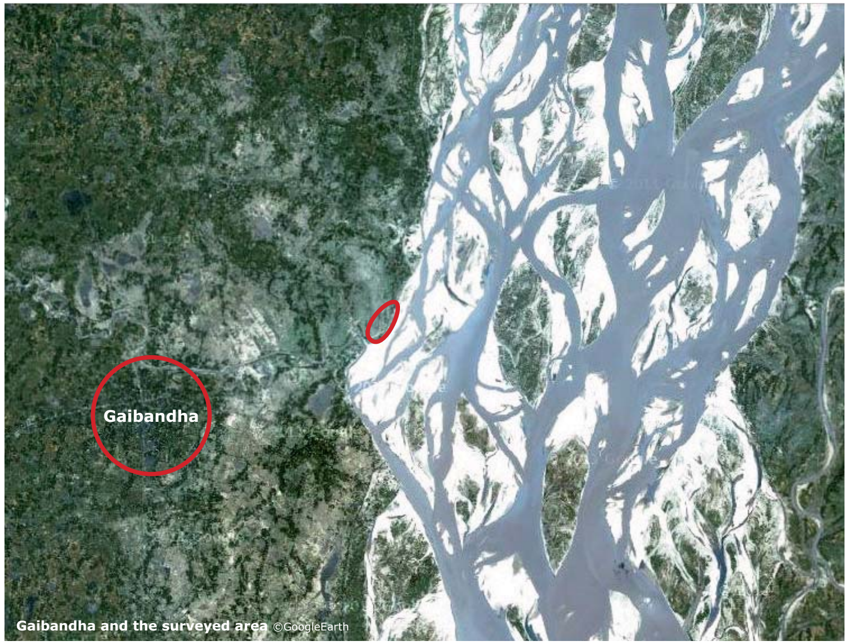
SOCIO-ECONOMIC PROFILE

Population

The local community is divided between people living in the countryside (settled people) and those installed on the old embankment (displaced every 5-7 years)

Main activities

agriculture labours, farmers or daily labours



Gaibandha and the surveyed area ©GoogleEarth

LOCAL RISKS

Floods

- annual floods: during rainy season, water level: house plinth
- regular floods: water level: 70-90cm, every 2-3 years
- extraordinary floods: water level 40-50cm, but sometimes upto 1.70m (1998, 2007)
- sometimes with strong current (overflow or breaking of the embankment)
- local knowledge for flood prediction:
  - observation of the river after some days of rain
  - behaviour of animals
    - ants come out from the ground and go up
    - when kukua birds sing louder, flood will comes shortly

River banks erosion

- every 5 years the embankment is destroyed
- continuous change of river path: the existing embankment is perpendicular to the current river path

Strong winds

- seasonal: months of April-May
- cyclones: every 3 years
- tornados: rare, once every 30 years (last time in 2007)

Earthquakes

- medium risk
- not reported by the population

Cold waves

site

Upazila	Sadar
Union	Gidari
Ward	6

zone rural

morphology
flat land on the banks of Jamuna river

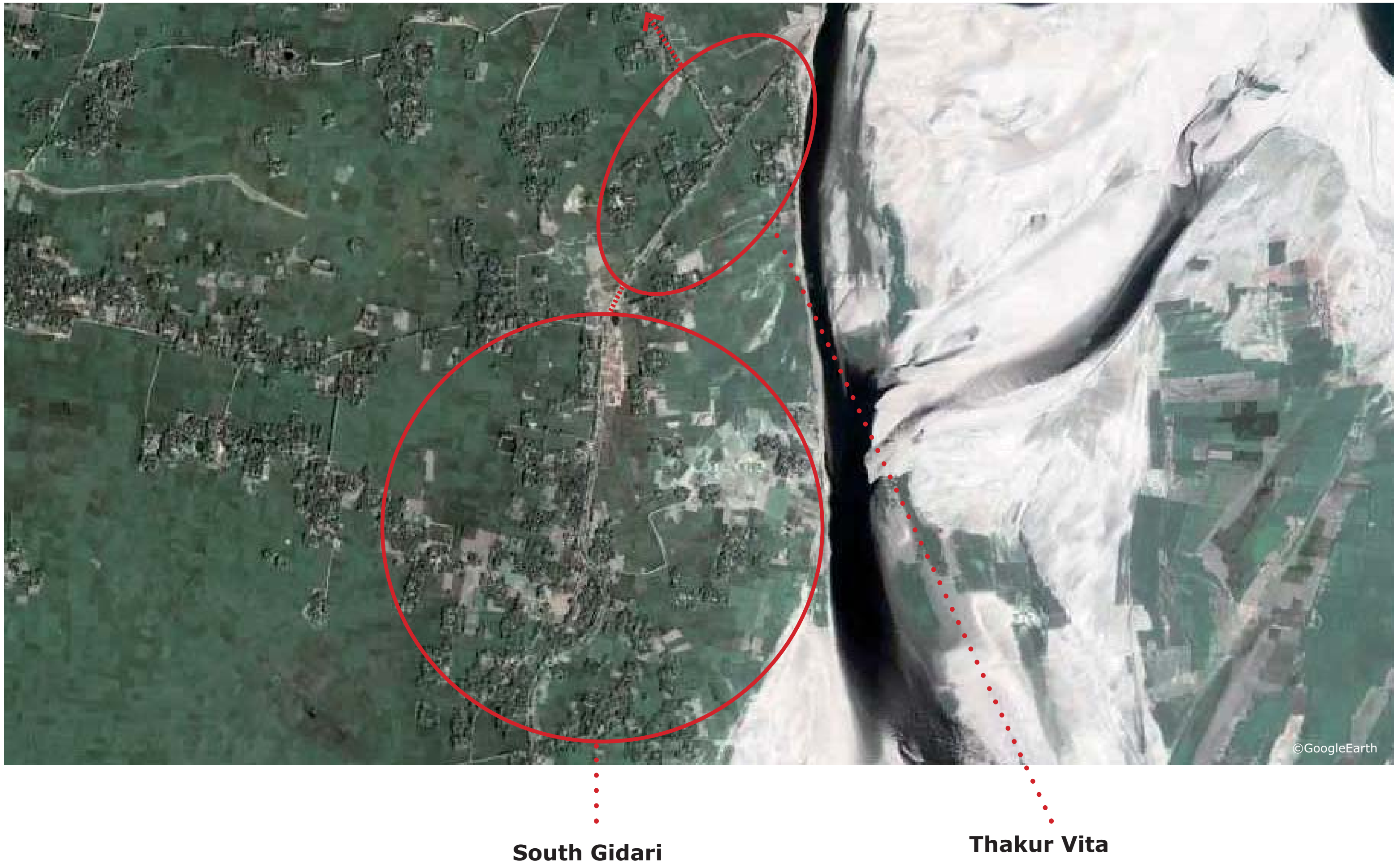
access
45min by car from Gaibandha, unpaved road

settlement implantation site
- area protected by the embankment (South Gidari)
- on top and on the sides of the old embankment (Thakur Vita)

facilities
2 primary schools
1 maternity clinic

protection from local risks
- floods: none or homesteads on a raised mound
- river banks erosion: none
- strong winds: trees around the house

households 178
enlarged families
family sizes:
- small: 3-4 p
- medium: 5-6 p
- large: 7-8 p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housing typologies

In the area protected by the embankment, the land is property of the people who live on it. Habitats comprise houses of various members of the same family and are sometimes separated by agricultural land.
People living on the embankment don't own any land (government ownership). The houses are very close, leaving little free space.

The house is generally southwest facing for more light and air, but sometimes the orientation changes depending on the particular situation of the house (ex. a house that is directly exposed to the wind coming from the river, will be oriented with the short side oriented perpendicular to wind direction).

Housing typology is the same for both groups: rectangular plan with the entrance placed on the longest side.
Usually the house consists of only one piece (80% of the houses), very few have 2 rooms (20%).

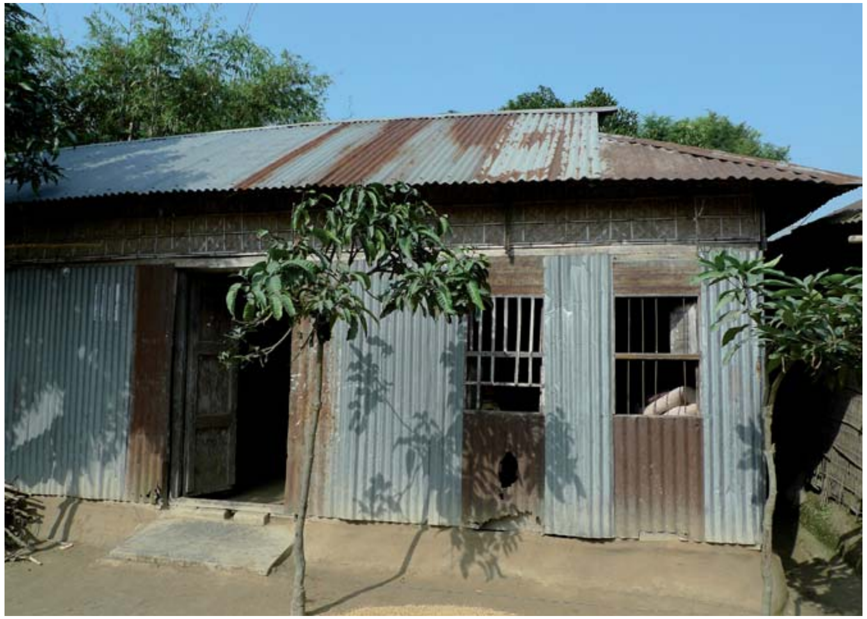
The kitchen is placed outside, in front of the house and sometimes it is sheltered by a bamboo and palm leaves structure.
Inside the house, a platform occupies one of the short sides; it is used to store the crops and as shelter during floods.
Animals are kept inside the house, in the same room as the people or in a separate room accessible from the inside and outside the home.

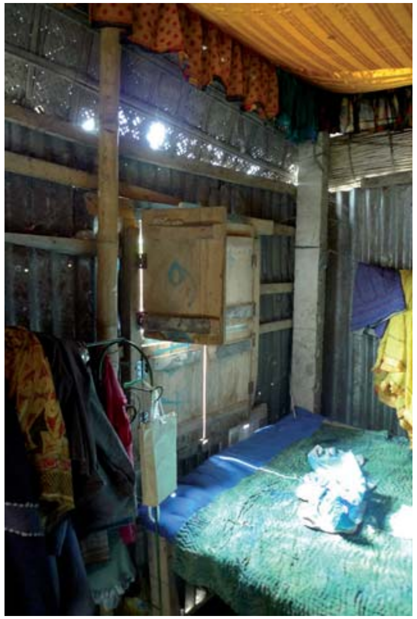
No house has a veranda.

housing typologies

House in protected area (countryside)

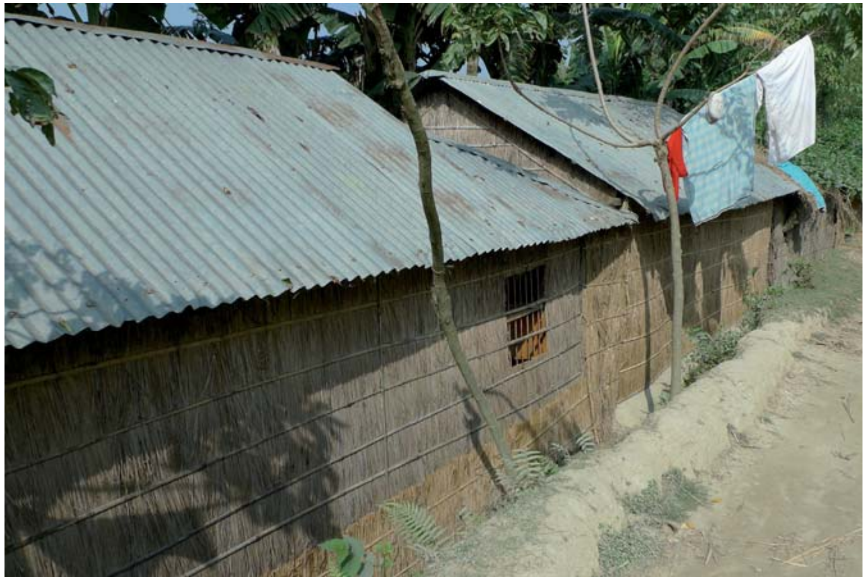
Dimensions:	8.5x6m
Room height:	2.4m

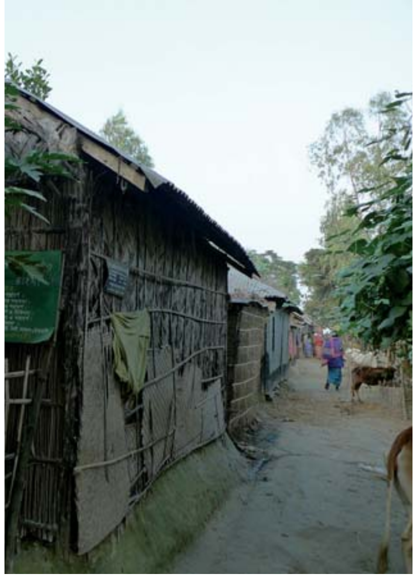




Houses on the embankement

Dimensions:	5x3m
Room height:	1.8m

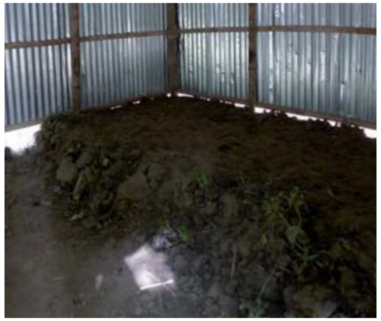


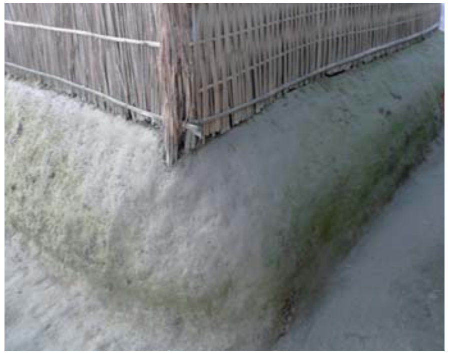


construction features

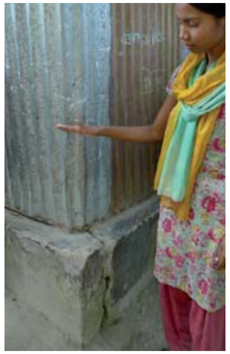
FOUNDATIONS/PLINTH

- any type of foundation is used
- the compressed earth plinth is built after the posts setting
- plinth height 0-20cm for houses on the embankment, 20-50cm for the houses on the countryside
- any drainage is done around the house

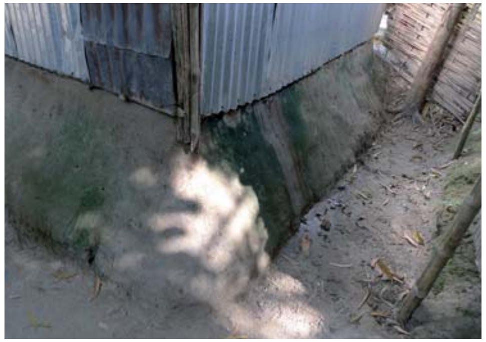




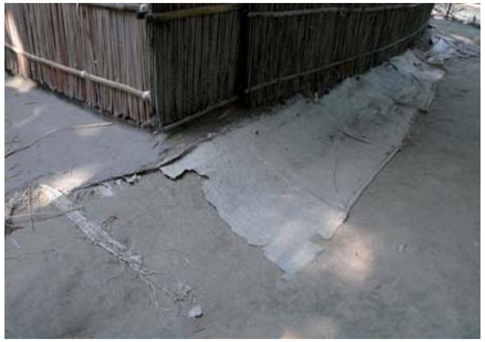
The plinth has a convex shape to facilitate the setting of the mud mixture



Water level for regular floods (every 2-3 years)



Degradation caused by water erosion, insects, and lack of maintenance



Sometimes empty bags are used as protection against erosion

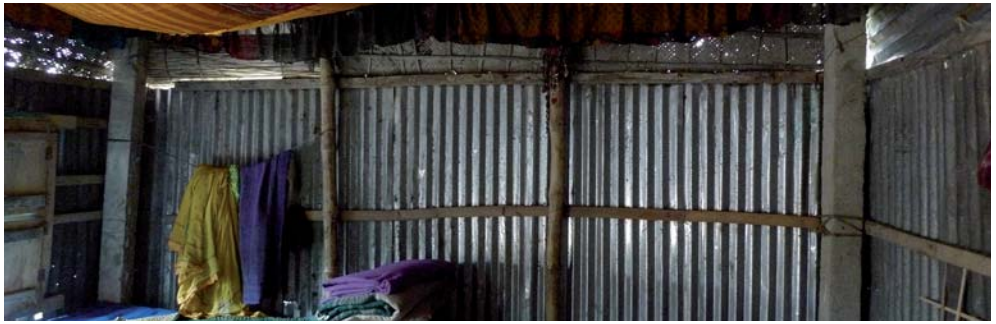
construction features

LOAD BEARING STRUCTURE

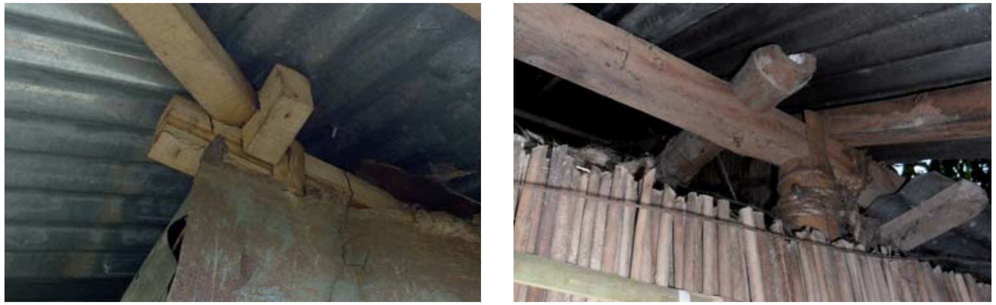
- bamboo or wooden posts directly into the ground
- structural framework:
  - bamboo posts: 50cm
  - wooden posts: 80-120cm
- no bracing is used
- damage at the base of the posts due to insects
- in case of flood with strong current, posts damaged by insects at the bottom part may break, causing partial or total collapse of the house

Joints

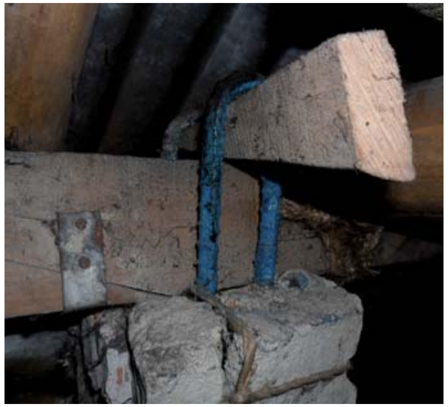
- often any type of bonding is done to connect structural members
- when connections are done: bamboo or jute ropes, iron wire or nails
- to extend beams length sometimes metal plates are used
- On the top of the RCC posts metal rods are provided as hooks to fix wall plate
- bonding with ropes of jute allow quick disassembly and reassembly of the house

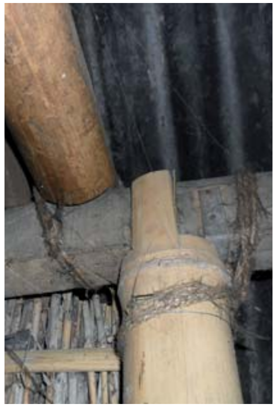


Mixed structure: concrete posts for the main structure and bamboo and/or wooden posts for the secondary structure



On the top of bamboo posts a special carving to allow a better fixing of the beam. Special carvings are also done for bamboo beams and wooden posts connection.

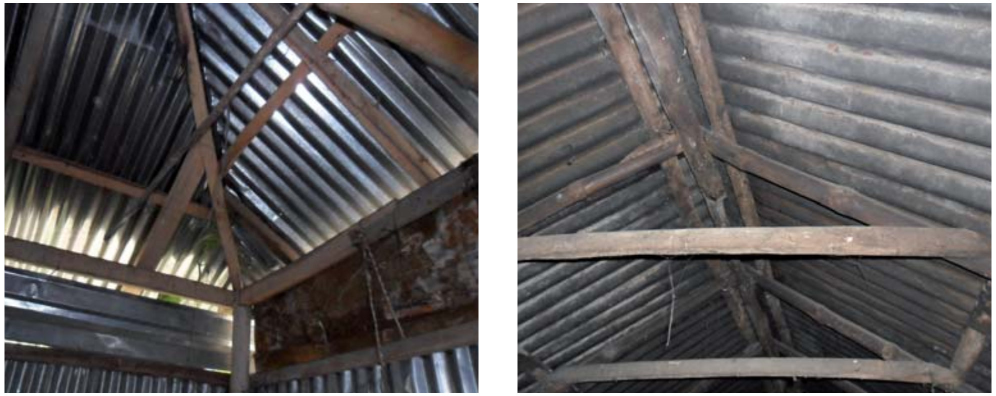




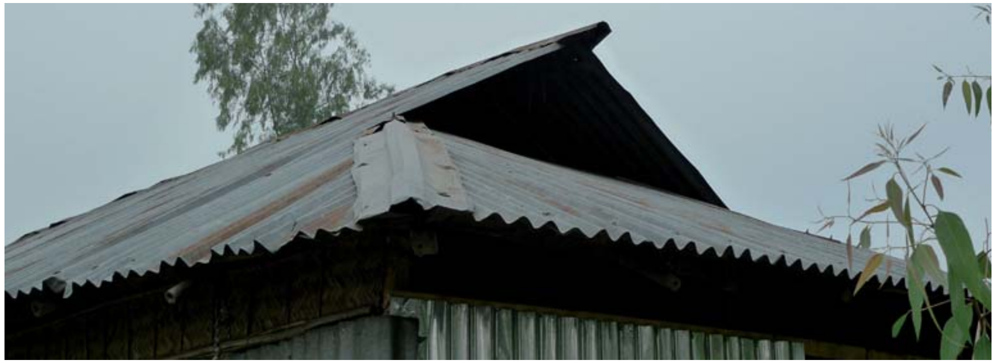
construction features

ROOF

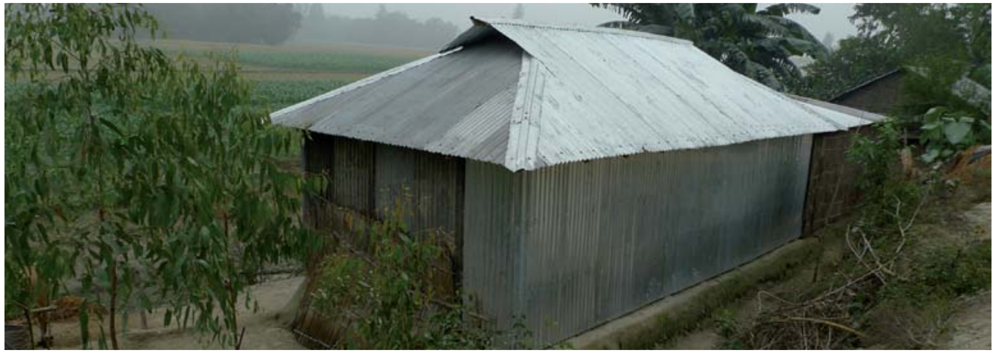
- 4 slopes roof (improved wind and rain protection)
- sometimes 1 or 2 slopes roof is done, but there is water penetration problems from the gable
- bamboo and/or wooden structure
- CGI sheets (fixed with screws) and rarely thatch (rice) covering
- eaves: 45cm

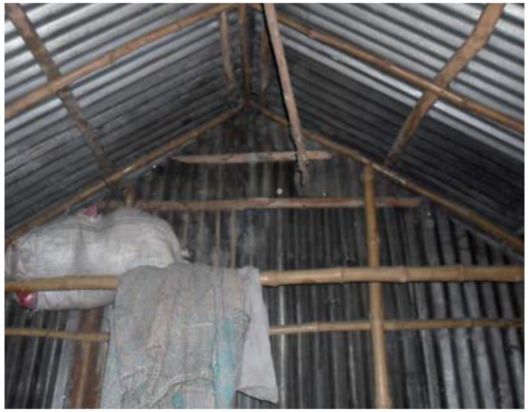


For 4 slopes roof: in the corner wooden rafters are used to improve wind resistance, others rafters are in bamboo (reduction of the overall cost)



4 slopes roof: ridge piece with pointed shape to break the wind





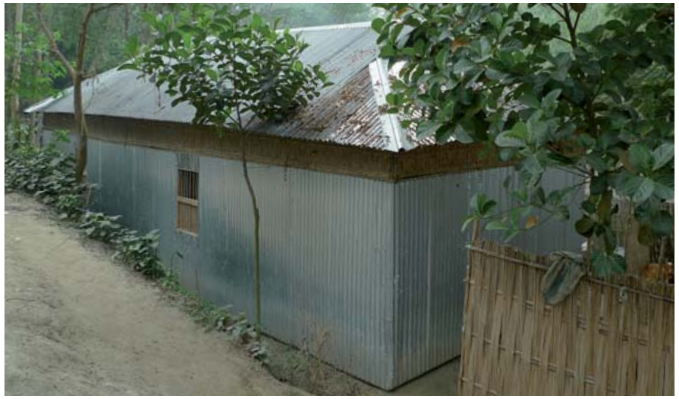
construction features

FENCES

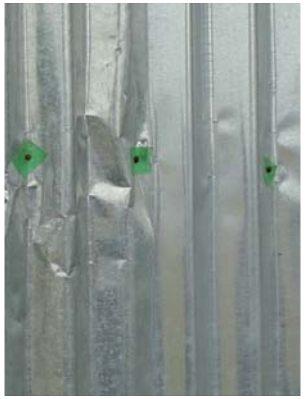
Two types of fences:
- CGI sheets:
    - fences nailed to the posts and to a secondary inner wooden structure
    - very bad thermal insulation capacity
- jute sticks fences:
    - fences tied to the bamboo primary structure and to bamboo horizontal stiffeners
    - double fences at bottom part of the outer side of the fences (improved rain protection and repairing cost reduction)
    - good thermal insulation
    - sometimes plastic sheets are used on the inner side of the fence (water penetration protection)

Other types of fences:
- instead of jute sticks fences, Kasia/Bati (kind of grass) is sometimes used
- bamboo fences are rarely used; when it happens they are used mainly for the upper part of the wall

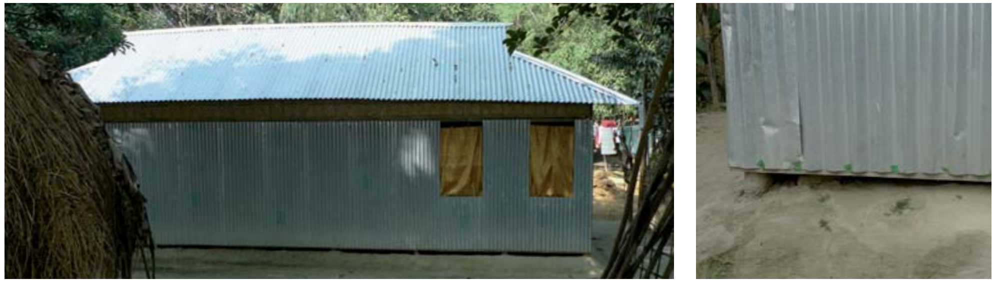
During floods all types of fences are damaged, except CGI sheets.



Due to the limited length of the CGI sheets, jute sticks or bamboo woven fences are placed on the top of the wall (40cm) to get a greater height and to improve ventilation of rooms



A CGI sheet or plastic piece placed between the nail and the CGI sheet fence prevents rusting



A gap (2.5-5cm) is left between the mud plinth and the fences (protection from humidity and insects)

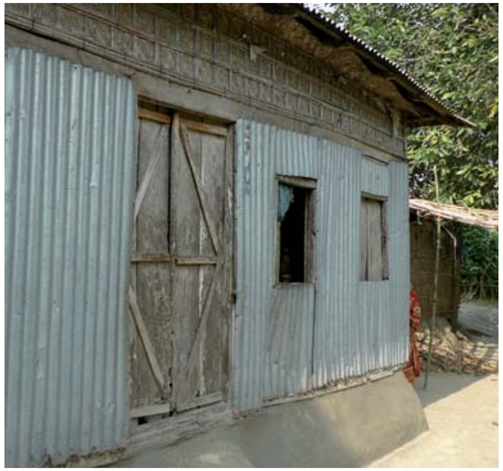
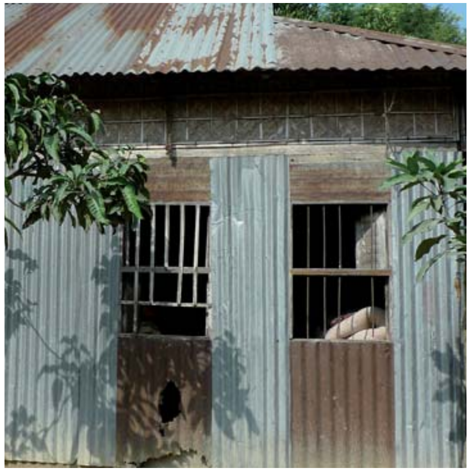
construction features

OPENINGS

Generally for houses on the embankment, any window is provided. People have to shift periodically so that they don't invest in openings.

On the countryside, houses have generally 1 or 2 windows per room. Usually they are cut in the CGI sheet or jute stick fences and sometimes they have a wooden frame.

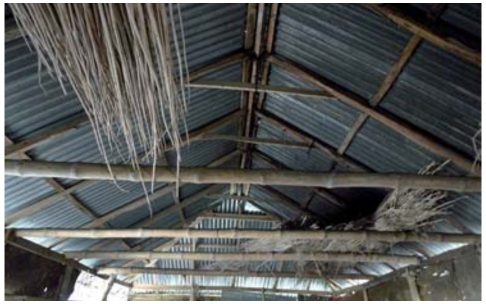
Under the door frame there is a gap, sometimes some bricks support the frame.

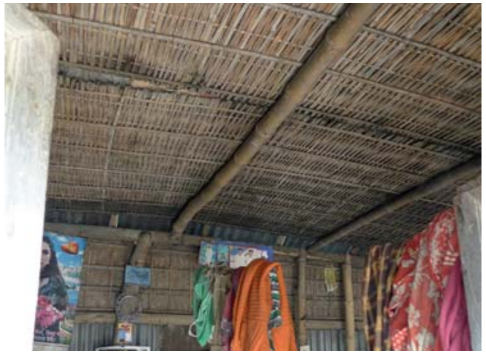



CEILING

Generally no ceiling is provided. When provided, ceiling is made with woven bamboo fences horizontally placed on the top of the posts.

The interior and exterior space under the roof is used for storage of materials.





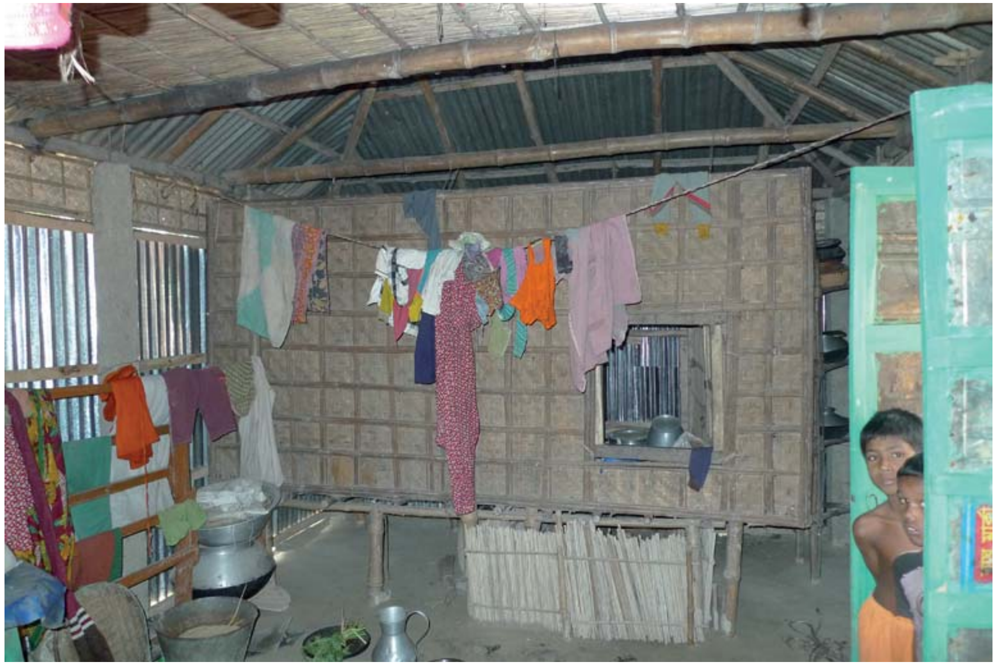
coping strategies

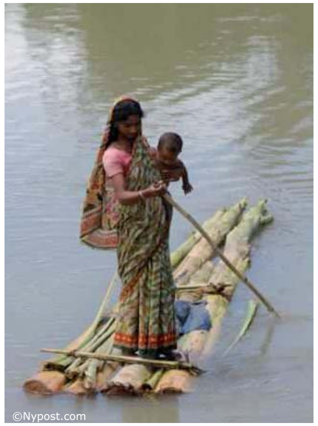
- People living on the embankment are cyclically forced to move due to river banks erosion and floods.When their house is threatened, people dismantle the house by parts and they displace it, by foot or by boat.

- In every house there is a bamboo platform (machan) elevated at 70-90cm from the ground, with walls (and sometimes ceiling) made with woven bamboo fences and a small window.
- All the furniture is raised with some bricks at a level slightly higher than the annual flood level.

- During floods:
  If the family has no animals, people stay in the house and when the water begins to enter inside the house, they move on the embankment. They borrow CGI sheets from others people to build a temporary shelter where they remain for 2-3 months.
  If the family has animals, people stay in the machan keeping the lights on and without sleeping for fear of snakes. When the water reaches the platform, they make rafts with banana trunks and they install the animals on that.

- After tornadoes, the materials of the destroyed houses are reused.





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building process

Construction season: November - March (dry season)

Time required to build a house: 7-8 days if all materials have been collected

Problems in the construction:
- small size of the plot
- poor quality of materials
- materials and labour costs

Artisans are chosen on acquaintance, proximity, low rate and quality of work criteria.
They work mainly on contract basis and the overall labour cost is fixed in relation to the size of the house.
They don't do a follow up of the constructions, but if there is any problem within a years from construction, they will repair it out of cost.

Sometimes to reduce costs, the owner and his family are involved in the construction as unskilled labor.

The most expensive parts of the house are fences, windows and doors.

maintenance

Mud plinth: every 5-7 days, task done by women

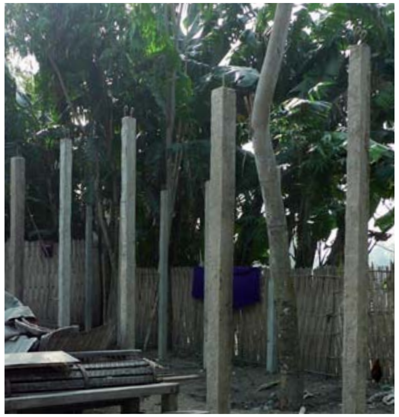
Bamboo structure:
- posts have to be changed every 2 years for damages due to insects at the bottom part
- beams are not affected by insects and may have a lifespan superior to 10 years
- the damaged part of the posts is cut down and the rest of the post is reused for other smaller constructions (kitchen)
- the new posts are cut by an artisan and installed by the owner repacking the mud of the plinth
- Katla (RCC base) under wooden post increase timber lifespan of about 10 times
- alternative solution to RCC base: PVC pipe filled with cement (solution seen by a villager in the Dhaka district, but not reproduced in the village)

Fences:
- jute stick fences: to be changed every year
- bamboo woven fences:
  - lifespan: 2 years (if in contact with water) to 7 years (if not in contact with water)
  - more costly than CGI sheet due to the amount of work required for the manufacture.

The damaged parts (posts and fences) are changed before the rainy season to prevent them from breaking during floods.

building materials

Bamboo
2 species:
Makhla: dia 4cm
wall thickness 0.6-1cm
used for fences
Borak: dia 8cm
wall thickness 1.5cm
used for main structure
Treatement:
- cutting when bamboo is mature (3 years old)
- soaking in the water (10 days)
- drying in the sun (15 days)

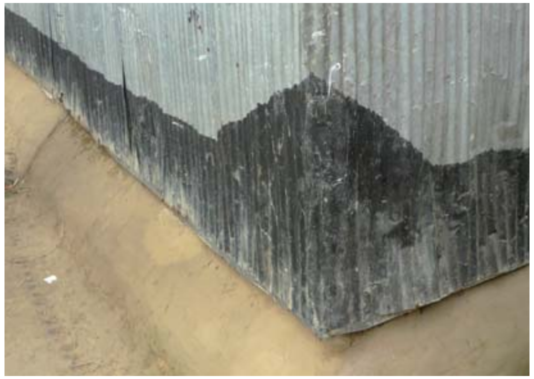


Wood
Species and treatment:
- Eucalyptus and shishu: soaking in the water (10-30 days) and drying in the sun (5-8 days)
- Neem and mango tree: no treatement

RCC pillars
- produced by an artisan of the village
- posts and metal rods dimensions:
  10x10cm – 8mm
  13x13cm – 10mm
- set 60 cm into the ground

Preservation
- Sometimes crude oil is applied on wooden elements (protection from insects)

- Bitumen is used on the bottom part of CGI sheet fences to improve resistance to rust and humidity degradation



Provenance of construction materials

Bamboo:	countryside houses have private plantation. People living on the embankment purchase it on the local market or from other villagers
Wood:	local market (Kamarjani)
Jute:	village
CGI sheet:	sub-district market (Dariapur)
RCC pillars:	village

Materials are generally purchased in the dry season and transported by cycle-rickshaw, cart, van or boat.

skills for construction

Mud plinth: generally made by the house owner with the help of some labours (family members, relatives or other persons).

Jute sticks or bamboo woven fences: usually made by a group of specialized artisans, but sometimes by the house owner himself.

Roof and main structure: built by a carpenter.

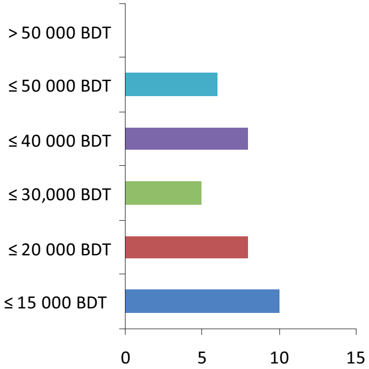
All carpenters, masons and fences artisans learn by working with a more experienced artisan. No training center is available nearby the village.

Cost of materials

Bamboo:	
Borak :	200-250 BDT
Makhla:	100-150 BDT
Eucalyptus:	400-450 BDT
Jute sticks:	12-15 BDT per bundles
Kasia/Bati:	2.00-2.50 per bundles
RCC pillars (3m):	80 BDT per hand

Artisans and labour cost

- carpenters :	22 persons	300 BDT/day
- masons:	6 persons	300-350 BDT/day
- fence artisans:	12 persons in the Ward	200BDT/day
- RCC artisan:	1 person	300 BDT/day



Costs of existing houses

first elements for pilot houses design

ELEMENTS TO CONSIDER

Architectural typology

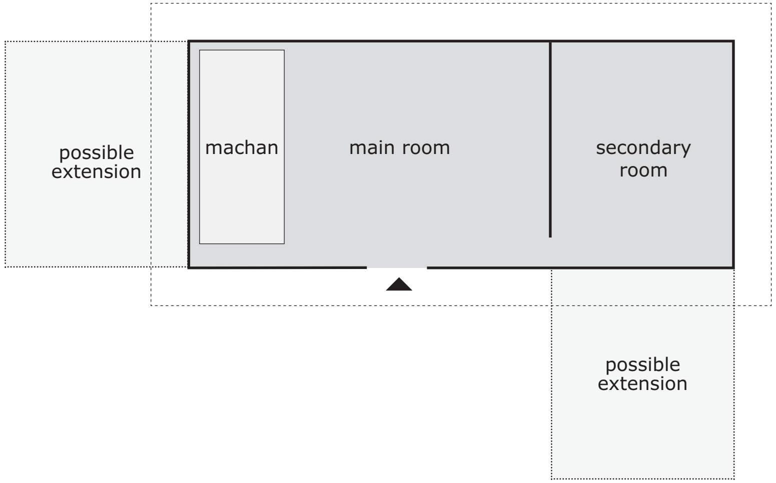
2 pilot house types according to local issues:

Type 1: for settled people (countryside)

Type 2: 1 for people that have to move and generally living on the embankment

Size: 2 rooms with enough space for a machan (to be built by the house owner)

Dimensions: 7.2x3m
Main room: 4.8x3m
Secondary room: 2.4x3m
Room height: 2.4m



Cost

Budget : 40000-60000 BDT per house

Construction features

Foundations/plinth
- mud plinth: height 45-60cm (according to plot situation)
- RCC base for bamboo posts with metal plate for connexion inside the bamboo post to prevent rust
- drainage around the house should be done

Load bearing structure

Type 1 :
- RCC pillars at the corners and secondary bamboo posts

Type 2 :
- bamboo posts
- connections allowing for quick dismantling/ reassembly and reuse of the construction elements
- bracing

Roof
- 4 slopes roof
- wooden rafters at the corners and intermediary bamboo rafters
- wooden purlings
- couvering: CGI sheets and ridge piece with pointed shape to break the wind

Fences
- jute sticks, Kasia/Bati or Makhla bamboo fences
- fences divided into 2 parts to reduce maintenance cost
- gap between plinth and fence to reduce fence damages

Openings
- one entrance door and one inside door to connect rooms
- 1 window per room, in front of the door to allow crossed ventilation

Ceiling
- bamboo woven fences horizontally placed (storage space and thermal insulation)

Other
- Treatment:
  Bamboo: borax and boric acid (to be verified in relation to local availability of materials)
  Jute sticks and kasia/bati (solution to be found)

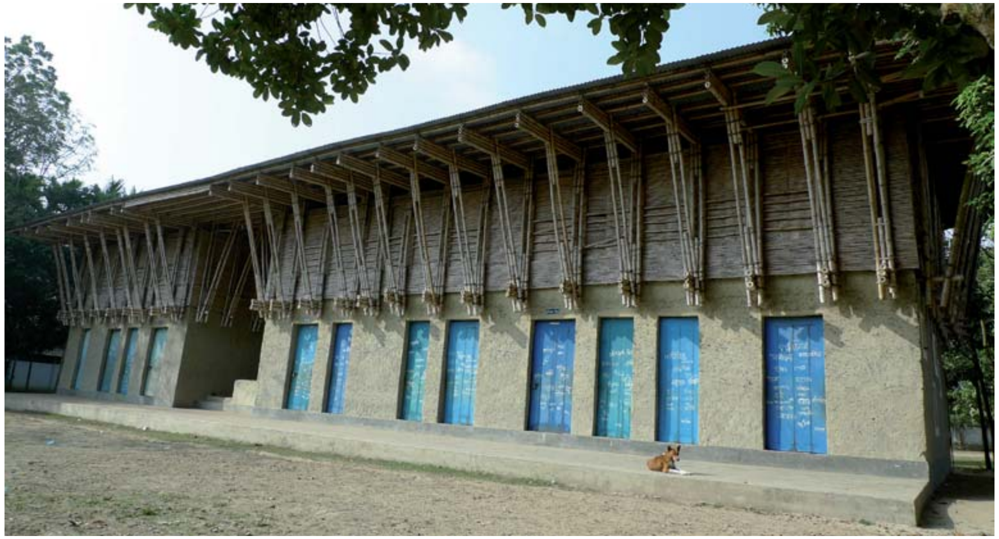
other visited projects

Dinajpur Division_Rudrapur Village

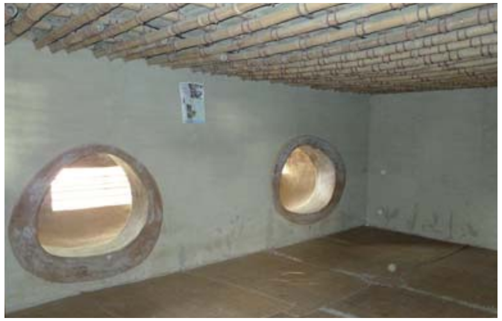
Projects realized as part of a collaboration between two organizations, Dipshikha (Bangladesh) and Shanti (Austria), and an Austrian architect, Anna Heringer.

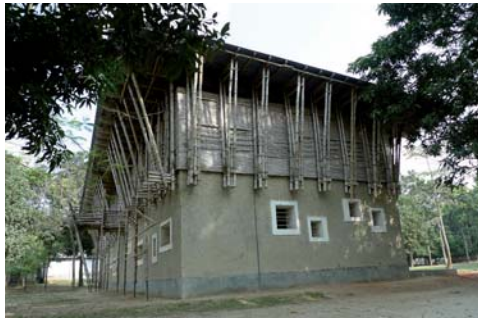
Interests of the projects in relation to the LCH pilot project developed by CB and BUET:

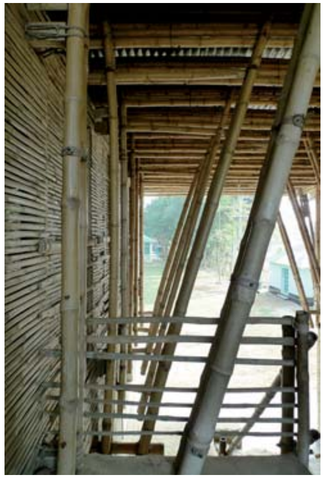
- use of local construction materials (bamboo, earth, coconut fiber)
- propositions of improvements to local construction practices
- involvement of the population in the project design and implementation
- training of local artisans and builders
- collaboration among: local communities, universities and local and international NGOs

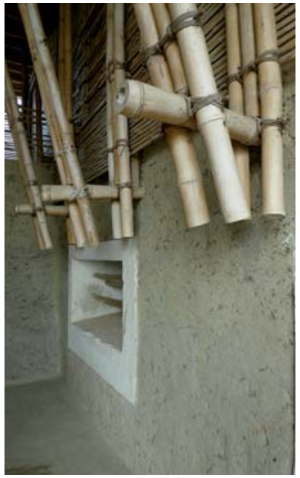


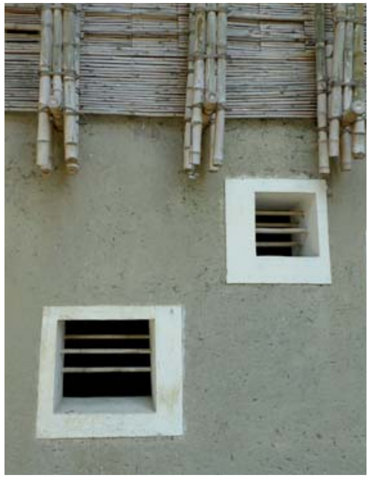
Meti School built in 2004

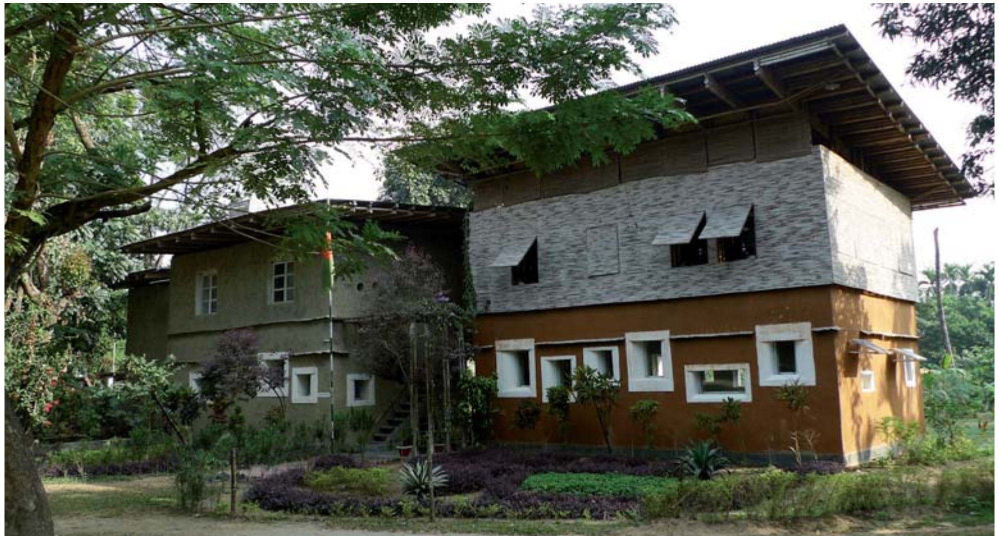




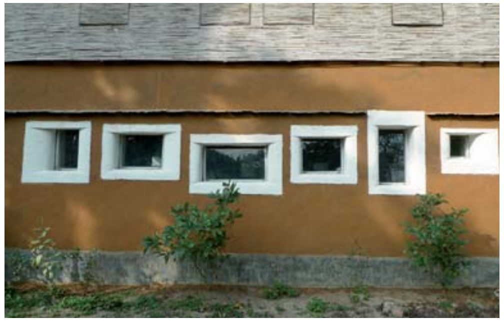


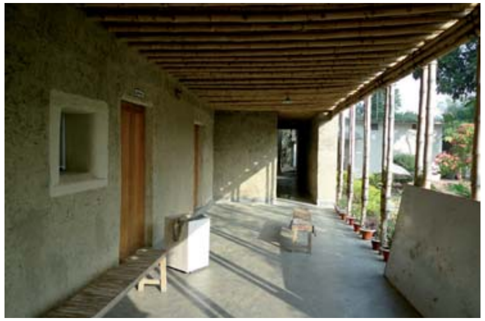


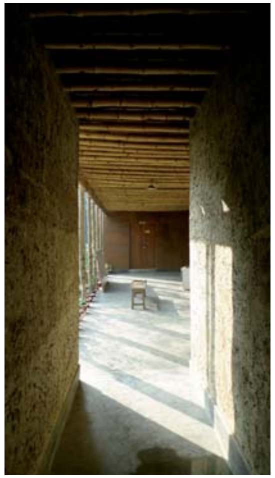


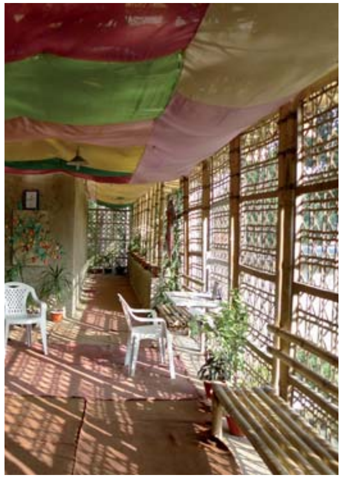


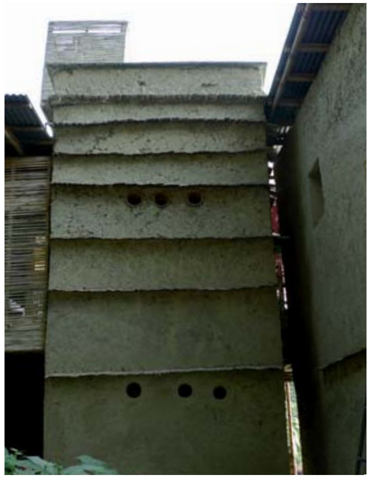
Desi School built in 2007

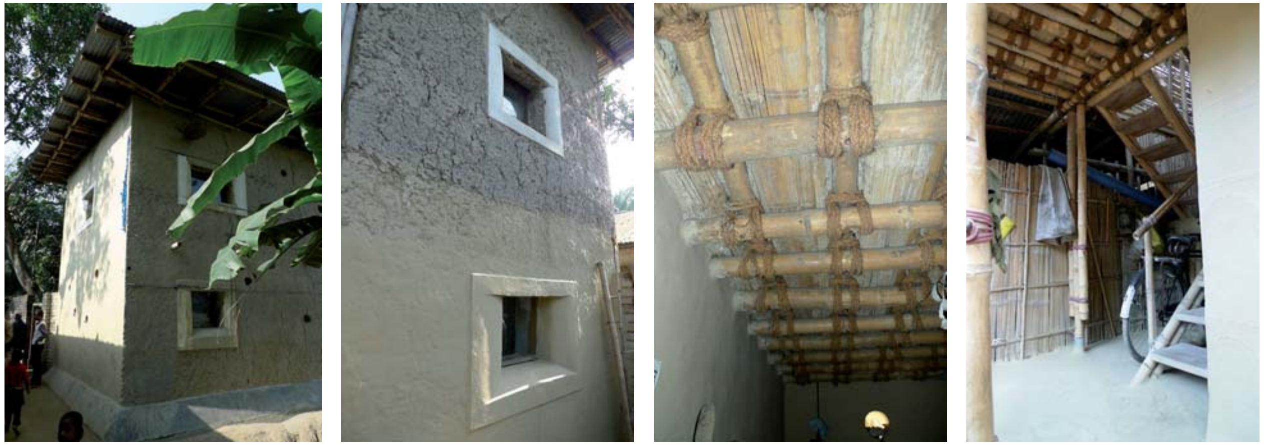




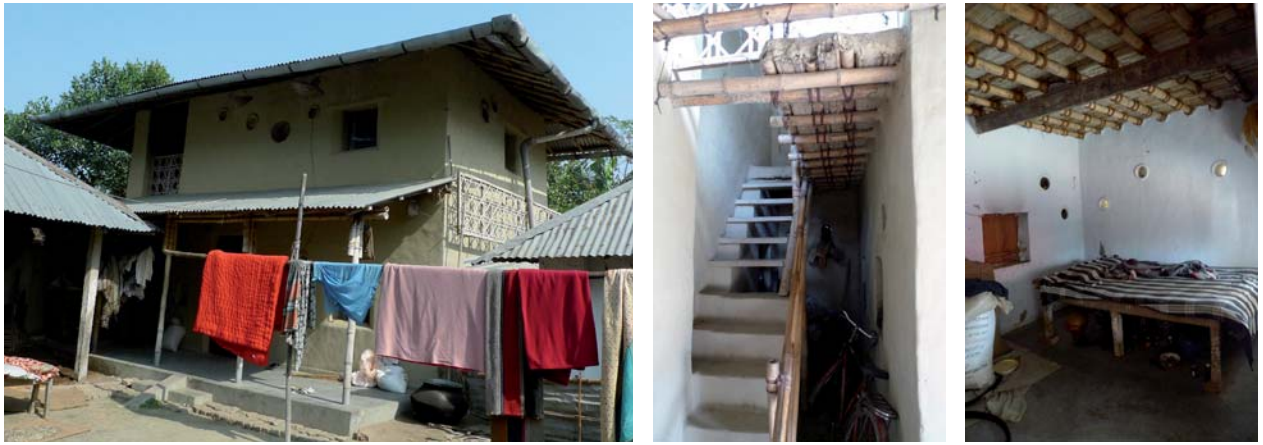




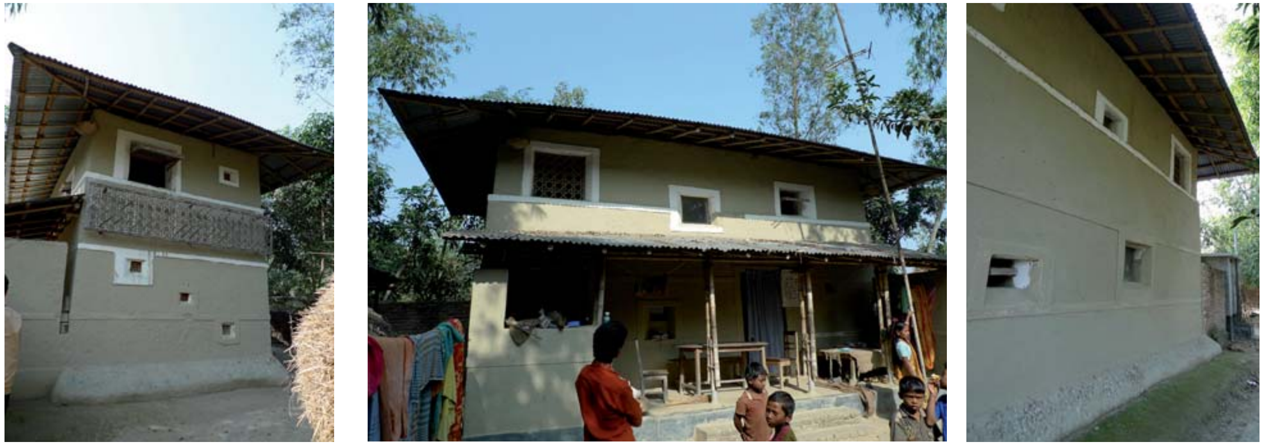




House 1



House 2

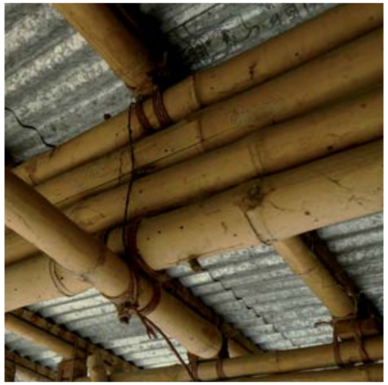


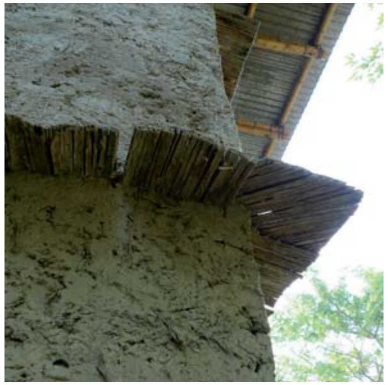
House 3

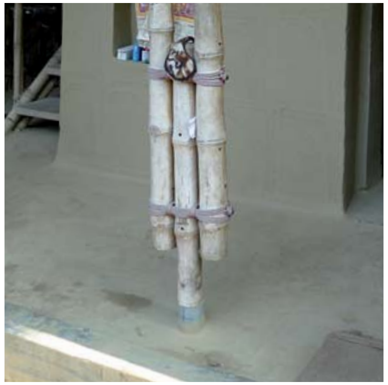
realized with the involvement of students from BRAC University (Dhaka/Bangladesh) and University of Art (Linz/Austia) and young architects.

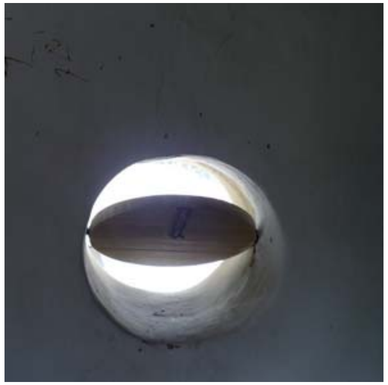
built in 2008

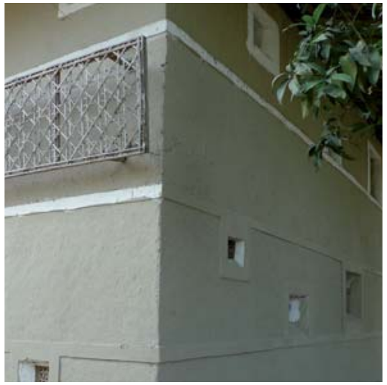
interesting features

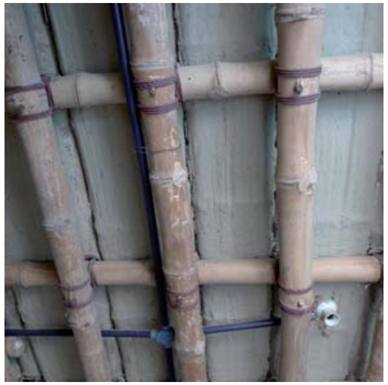

importance of bamboo treatment

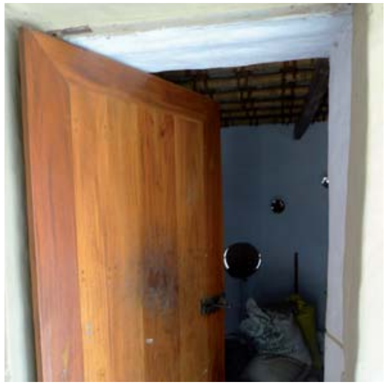

bamboo slices to reduce earthen wall erosion by rainwater

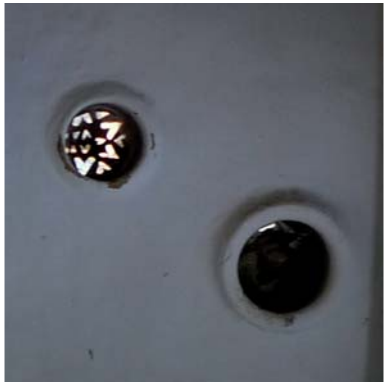

PVC base with cement infill and metal connections inside the bamboo post


frameless pivot windows (cost reduction)


lime plaster to protect the wall thickness reduction steps


floor with opened bamboo

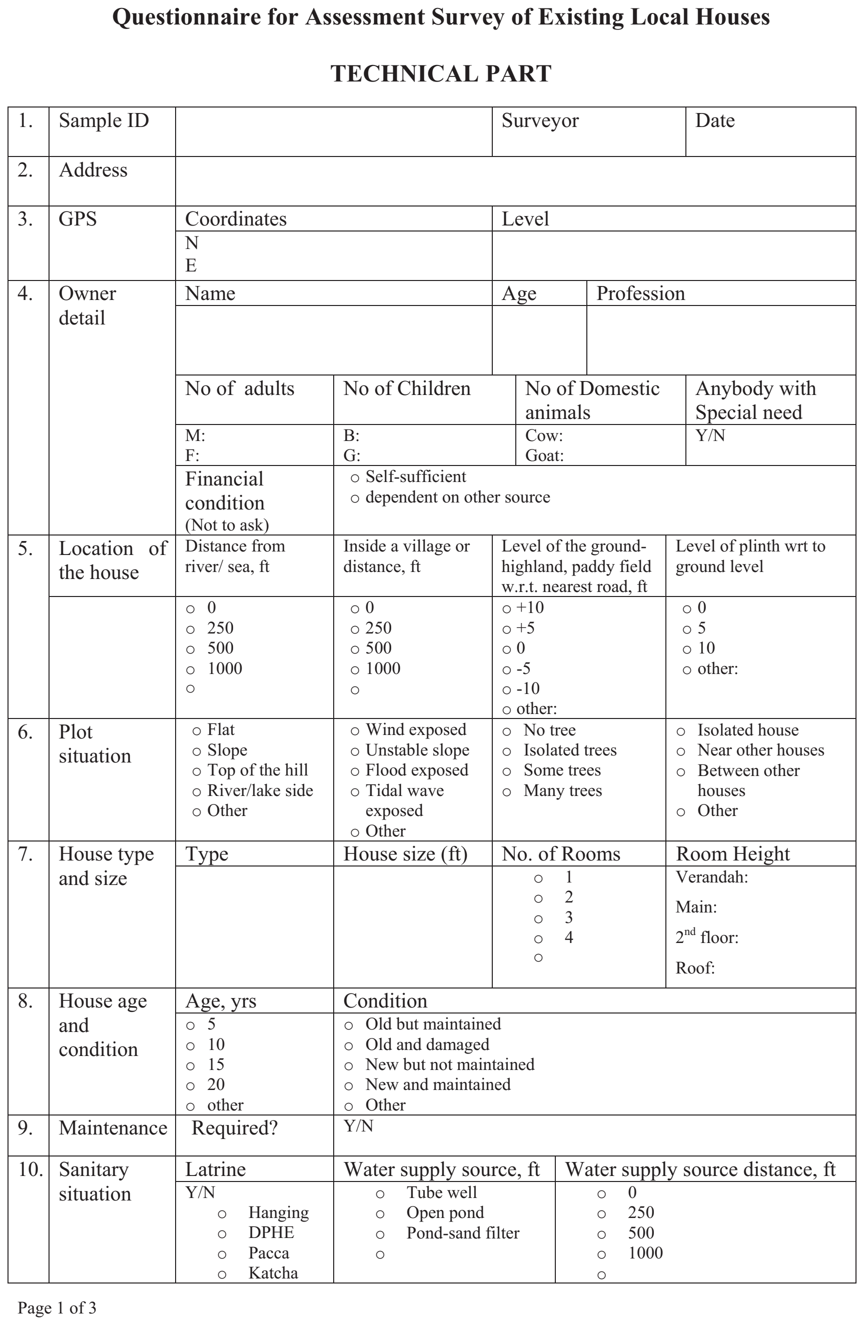

frameless rotating door


ponctual ventilation

annexes

1- Housing survey: technical questionnaire
2- Housing survey: detailed questionnaire
3- Group interviews/Community meeting: list of questions
4- Documentary sources
5- Day by day activities

annexe 1 : Housing survey: technical questionnaire



Questionnaire for Assessment Survey of Existing Local Houses

TECHNICAL PART

1.	Sample ID		Surveyor	Date	
2.	Address				
3.	GPS	Coordinates	Level		
		N E			
4.	Owner detail	Name	Age	Profession	
		No of adults	No of Children	No of Domestic animals	Anybody with Special need
		M: F:	B: G:	Cow: Goat:	Y/N
		Financial condition (Not to ask)	○ Self-sufficient ○ dependent on other source		
5.	Location of the house	Distance from river/ sea, ft	Inside a village or distance, ft	Level of the ground- highland, paddy field w.r.t. nearest road, ft	Level of plinth wrt to ground level
		○ 0 ○ 250 ○ 500 ○ 1000 ○	○ 0 ○ 250 ○ 500 ○ 1000 ○	○ +10 ○ +5 ○ 0 ○ -5 ○ -10 ○ other:	○ 0 ○ 5 ○ 10 ○ other:
6.	Plot situation	○ Flat ○ Slope ○ Top of the hill ○ River/lake side ○ Other	○ Wind exposed ○ Unstable slope ○ Flood exposed ○ Tidal wave exposed ○ Other	○ No tree ○ Isolated trees ○ Some trees ○ Many trees	○ Isolated house ○ Near other houses ○ Between other houses ○ Other
7.	House type and size	Type	House size (ft)	No. of Rooms	Room Height
				○ 1 ○ 2 ○ 3 ○ 4 ○	Verandah: Main: 2^{nd} floor: Roof:
8.	House age and condition	Age, yrs	Condition		
		○ 5 ○ 10 ○ 15 ○ 20 ○ other	○ Old but maintained ○ Old and damaged ○ New but not maintained ○ New and maintained ○ Other		
9.	Maintenance	Required?	Y/N		
10.	Sanitary situation	Latrine	Water supply source, ft	Water supply source distance, ft	
		Y/N ○ Hanging ○ DPHE ○ Pacca ○ Katcha	○ Tube well ○ Open pond ○ Pond-sand filter ○	○ 0 ○ 250 ○ 500 ○ 1000 ○	

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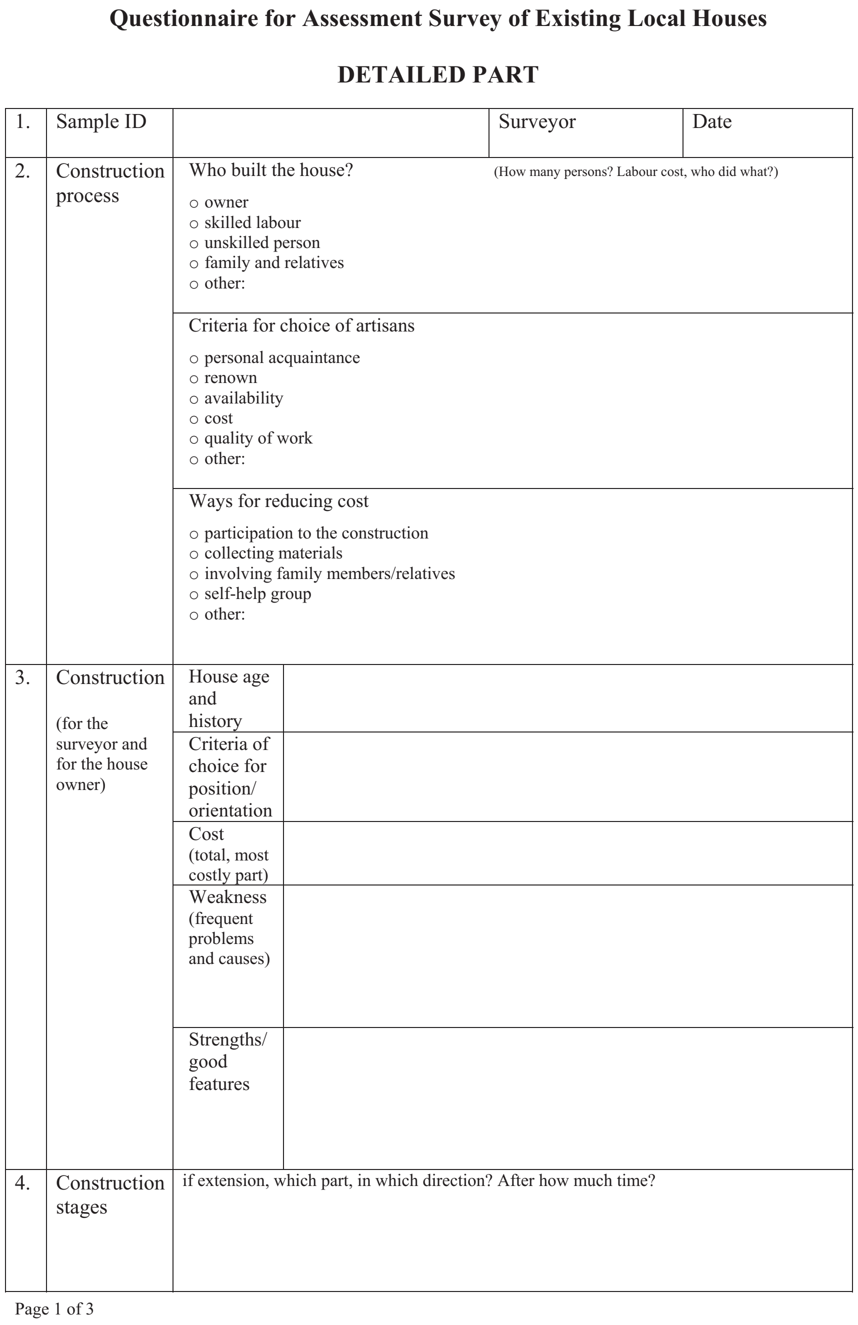
11.	Assessment of the Structure	Structural system Cost: Source of finance:	Framing: timber/bamboo/RC/other Fence: GI sheet/bamboo/mud/thatched/ other Roof: GI sheet/thatched/other		
		Height of the house? Facing of the house?			
		Foundation	Type:	Level of plinth	Soil condition?
				ft from existing ground level	
		Post sizes (reinforcement)			
		Beam sizes (reinforcement)			
		Cross bracing sizes (reinforcement)			
		Roof detail	Two pitch/Four pitch Timber/Bamboo/Steel		
		Connections of members			
		Opening			
		Special arrangement?	Y/N		
12.	Experience of last disaster: ○ extreme storm ○ rainfall ○ earthquake ○ flash flood ○ land slide ○ other	Duration, mins/days	○ 15 ○ 30 ○ 60 ○ 90 ○ other ( )		
		Rainfall	○ mild ○ moderate/submerged ○ strong ○ very strong (washed away)		
		Force of wind	○ Mild ○ Strong ○ very strong(trees, houses uprooted)		
		Main wind direction			
		Water level, ft	○ 5 ft above the plinth ○ 10 ○ 15 ○ 20 ○ other ( )		
		Maximum flood level in river w.r.t. embankment/road top			
		Tree damaged?	○ No damage ○ Minor damage ○ major damage ○ all uprooted		

13.	Photo taken (note serial no) (Front, side, Back, Isometric, Inside all directions, roofing system)	
14.	Draw sketches	Plan, sections, views with dimensions

Note: Materials to be collected for testing at selected locations/sites
Foundation soil- Identification No____________________
Material- Bamboo/Timber/Mud/Thatch/Cane etc.,-Identification No__________________

annexe 2 : Housing survey: detailed questionnaire



Questionnaire for Assessment Survey of Existing Local Houses

DETAILED PART

1.	Sample ID		Surveyor	Date
2.	Construction process	Who built the house? ○ owner ○ skilled labour ○ unskilled person ○ family and relatives ○ other:	(How many persons? Labour cost, who did what?)	
		Criteria for choice of artisans ○ personal acquaintance ○ renown ○ availability ○ cost ○ quality of work ○ other:		
		Ways for reducing cost ○ participation to the construction ○ collecting materials ○ involving family members/relatives ○ self-help group ○ other:		
3.	Construction (for the surveyor and for the house owner)	House age and history		
		Criteria of choice for position/ orientation		
		Cost (total, most costly part)		
		Weakness (frequent problems and causes)		
		Strengths/ good features		
4.	Construction stages	if extension, which part, in which direction? After how much time?		

Page 1 of 3

5.	Materials	Provenance and distance/ availability/ cost ○ land of the house owner ○ nearby the village ○ local market ○ other:
		Types, quality and building part for which it is used (wood, bamboo, mud,etc)
		Criteria of choice

6.	Maintenance/ improvement (done and suggested)	Which Part needs maintenance? frequency	What has to be done? How to do it? Who do it?	Cost

7.	Disaster ○ extreme storm ○ rainfall ○ earthquake ○ flash flood ○ river flood ○ land slide ○ other	Does your family feel safe in the current house?	
		Where do you shelter?	○ Stayed home ○ Embankment/road ○ Shelter/school ○ other
		How do you prepare to a disaster?	
		Description (duration, after how much time situation returns normal, how do you manage)	
		Damages to buildings	
		Damages to surrounding environment	
		Is it possible to made the house safer? How? (at house level, surrounding environment, trees more resistant)	

8.	Sketches	House function, space arrangement) + surrounding environment (trees, other houses, plot arrangement)

annexe 3 : Group interviews/Community meeting: list of questions

Bullet points for Assessment Survey of Existing Local Building Practices

COMMUNITY DISCUSSION

0. SITE (to be done by surveyor)

0.1 • Area (urban / suburban / rural)

0.2 • Description of the area (relief and vegetation)

0.3 • Settlement pattern (scattered / clustered / linear along a road / other)

0.4 • Site management, main infrastructures, description of the village/settlement

1. GENERAL INFORMATION

1.1 • Population (number of inhabitants, distribution patterns,…)

1.2 • History of the village (year of foundation, evolution of the built environment, settlement creation,…)

1.3 • Main sources of income, seasonal activities

1.4 • Accessibility to the village (throughout the year / depending on the season, distance from other villages / towns)

1.5 • Landownership and land management (private plot/collective land, how village land is divided in relation to different purpose: housing, agricultural, forest, etc)

2. CONSTRUCTION

2.1 • Types of construction (%, good features, weakness, cost, maintenance, lifespan, still employed, natural hazards)

2.2 • Criteria for house position and orientation

2.3 • Criteria for building technique and materials choice

2.4 • Main difficulties for construction

2.5 • Ways to improve the durability of buildings (treatment, period of collecting, technical solutions)

2.6 • Positive aspects of the techniques that are no longer used and possible improvements

3. FUNDING

3.1 • More costly part of the construction (foundation, plinth, load bearing structure, partition walls, roof, woodwork, finishing works / material, transport, implementation)

3.2 • Ways for reducing costs

4. ORGANIZATION IN THE CONSTRUCTION

4.1 • Season for construction

4.2 • Tasks and roles (collecting materials, excavation/site preparation, foundation/plinth, load bearing structure, partition walls, roof, woodwork, finishing works)

4.3 • Skills needed (artisans provenance, tasks)

4.4 • Agreements between owner and artisans

4.5 • Construction phases (which parts, in which direction, how much time between different stages)

4.6 • Time and labour needs for the construction of a basic house

5. SKILLS

5.1 • Artisans in the village (masons, carpenters, others, provenance)

5.2 • Continuity of work through the year

5.3 • Labour rate per day (unskilled labour, skilled labour, foreman)

5.4 • Ways of learning (with a more skilled artisan, training centre)

5.5 • Training centre

5.6 • Artisans organization (groups of artisans, how many, equipments, skills, are of work)

4.6 • Monitoring by artisans

5.7 • Exchanges among artisans

6. RESOURCES

6.1 • Quarry / forest for construction purpose

6.2 • Water source (permanent/season, spring/pond/backwater/river/well/pumps, number and the distance from the village, private/community)

6.3 • Construction materials (use, types, supply, collect, processing/treatment, problems, problems)

natural: wood, bamboo, mud, straw/grass, ….

industrial: bricks, CU sheet, metal bars, cement,…

6.5 • Building techniques no more used and lost/disappearing know-how

7. NATURAL HAZARDS and RISKS (to be adapted to local hazards)

7.1 • Types and frequency

7.2 • Description

7.3 • Particular powerful event (frequency, description)

7.4 • Ways to know that a disaster is coming

7.5 • Behaviour during a disaster

7.6 • Frequent / occasional damages in the village

7.7 • Most and less affected types of construction

7.8 • Repairing works (type, who did it, any improvement done?)

7.9 • Materials available and reusable (type, provenance, quantity available, etc.)

7.10 • Specific measures to reduce the damages (in the construction and in the surrounding of the house, can a building made safer? If yes, how?)

7.8 • Part of the village more exposed

annexe 4 : Documentary sources

Publications

Haq et Chattopadhayay-Dutt (2007), *Battling with the storm. Study on cyclone resistant housing*, German Red Cross, Dhaka

Hasan, Ullah, Gomes (2000), *Rural housing in Bangladesh: an enquiry into housing typology, construction technology and indigenous practices*, conference proceedings, H&H 2000 Conference, Dhaka et Exeter

Hodgson et Carter (1999), Some factors governing choices of building materials in rural Bangladesh, conference proceedings, Affordable Village Building Technology, Dhaka

Nahiduzzaman et Haas (2008), *Micro Climatic House Design: A Way To Adapt To Climate Change? The Case Of Ghar Kumarpur Village In Bangladesh*, Theoretical and Empirical Researches in Urban Management, Year 3, Number 9

Population & Housing Census: Preliminary Results, Bangladesh Bureau of Statistics, Statistics Division, Ministry of
Planning, Government of the People’s Republic of Bangladesh, Julliet 2011

Rashid R. (2007), *Traditional House of Bangladesh: Typology of house according to materials and location*, Virtual Conference on Sustainable Architecture Design and Urban Planning, AsiaSustainabilityNet.upc.edu, 15-24 september

Uddin N. (2008), *A study on the traditional housing technology of Bangladesh*, Indian Journal of Traditional Knowledge, vol. 7(3), juillet, pp. 494-500

Websites

- Banglapedia
  http://www.banglapedia.org

- Wikipedia
  http://www.wikipedia.org/

- Bangladesh Bureau of Statistic
  http://www.bbs.gov.bd

- Chittagong Hill Tracts Development Facilities
  www.chtdf.org

- SAAR, South Asian Disaster Report, 2007 et 2008
  www.saarc-sdmc.nic.in

- Bangladesh development Research Center
  http://www.bangladeshstudies.org

- Disaster management Information Network
  http://www.dmic.org.bd

annexe 5 : Day by day activities

22.11.2011
- Departure from Geneva to Dubai and Dhaka

23.11.2011
- Arrival in Dhaka
- Departure/arrival in Chittagong
- Meeting with Chittagong regional office staff (James Gomes,regional director; Mazharul Islam, Disaster Management Department), BUET representative (Mohammad Shariful Islam, Thazin Reza Hossain, Shamima Nasrin), and Ratan Kumar Podder (CB national office)

24.11.2011
- departure for Bandaraban (2h)
- Limu Jhiri Para: transect walk and meeting with local community
- Limu Jhiri Para: housing survey

25.11.2011
- Aga Para: housing survey
- Limu Jhiri Para: housing survey
- Visit of CB training centre in Bandarban

26.11.2011
- Departure of Mohammad Shariful Islam et Thazin Reza Hossain for Chittagong/Dhaka
- Limu Jhiri Para: meeting with local community and artisans
- Jhiri Maddam Para: transect walk
- Jhiri Maddam Para: transect walk
- Boikkhong Para: transect walk

27.11.2011
- Limu Jhiri Maddam Para and Boikkhong Para: housing survey
- Manto Para: transect walk
- Limu Jhiri Para: meeting with local artisans

28.11.2011
- Departure for Chittagong
- Visit to Silvicultural Research Station, Bangladesh Forest Reseach Institute, Keochia
- Meeting with James Gomes, regional director
- Meeting with Samuel Berthet director of Alliance Française

29.11.2011
- Departure for Dhaka

30.11.2011
- Work at CB office: preparation of preliminary report for Chittagong region

01.12.2011
- Work at CB office: preparation of preliminary report for Chittagong region

02.12.2011
- Work at CB office: preparation of preliminary report for Chittagong region

03.12.2011
- Work at CB office: preparation of preliminary report for Chittagong region

04.12.2011
- Work at CB office: work on survey methodology

05.12.2011
- Work at CB office: work on survey methodology

06.12.2011
- Departure for Rajshahi (7h)
- Meeeting CB-Rajshahi regional staff (Augustine D'Cruze, regional officer; Golam Rosul, regional officer; Denis C. Baskey regional directeur), BUET representative (Mohammad Shariful Islam, Thazin Reza Hossain, Shamima Nasrin), and Ratan Kumar Podder (CB national office)

07.12.2011
- Departure for Hiradanga, Porsha Upazila (2h30)
- Hiradanga: meeting with local community and transect walk
- Hiradanga: housing survey

08.12.2011
- Hiradanga: housing survey
- Uchadanga: visit of a house under construction
- Uchadanga: meeting with local community and artisans
- Departure for Gaibandha (4h30)

09.12.2011
- Departure for South Gidari (45min)
- South Gidari: meeting with local community and transect walk
- Departure of Mohammad Shariful Islam and Thazin Reza Hossain for Dhaka
- South Gidari: housing survey

10.12.2011
- South Gidari: housing survey
- South Gidari: meeting with local community and artisans
- Departure for Dinajpur (3h)

11.12.2011
- Departure for Rudrapur (1h)
- Rudrapur : visit of Dipshikha and Anna Heringer projects: Desi School, Meti School and 3 two storey houses
- Departure for Rajshahi (6h30)
- Meeting with Fanny Delgutte and Charles De Foucaucourt (Secours Catholique-Caritas France)

12.12.2011
- Uchadanga: meeting with local community
- Uchadanga: housing survey

13.12.2011
- Bash Para, : transect walk, housing survey and meting with local artisans
- Meeting with Rajshahi Bishop, Rev. Gervas Rozario

14.12.2011
- Departure for Dhaka

15.12.2011
- Work at CB office: preparation of preliminary report
- Meeting at BUET with Mohammad Shariful Islam and Tahsin Reza Hossain (BUET), Ratan Kumar Podder and Pintu Wiliam Gomes (CB national office)
- Meeting with Fanny Delgutte and Charles De Foucaucourt (Secours Catholique-Caritas France)

16.12.2011
- Work at CB office: preparation of preliminary report

17.12.2011
- Work at CB office: preparation of preliminary report

18.12.2011
- Work at CB office: preparation of preliminary report

19.12.2011
- Meeting with Dr. Benedict Alo D'Rozario (CB national office director)
- Meeting with Jyoti F. Gomes (Directeur du Disaster Managament Department-CB Nationale), Pintu Wiliam Gomes (Capacity Building, Disaster Management Department CB Nationale) and Ratan Kumar Podder (Programme Coordinator, Disaster Management Department, CB Nationale)
- Work at CB office: preparation of preliminary report

20.12.2011
- Work at CB office: preparation of preliminary report
- Departure for Dubai and Geneva

21.12.2011
- Arrival at Geneva

Persons met

Caritas Bangladesh:
- Benedict Alo D'Rozario, Director of CB National Office
- Ratan Kumar Podder, Program Coordinator, Disaster Management Department CB National Office
- Pintu Wiliam Gomes, Capacity Building, Disaster Management Department CB National Office
- James Gomes, Regional Director, Caritas Chittagong Region
- A.J.M. Mazharul Islam, Programme Officer, Disaster Management and Development, Caritas Chittagong Region
- Subash Tripura, local supervisor for Limu Jhiri Para area LCH Pilote Project
- Denis C. Baskey Directeur Caritas-Rajshahi
- Augustine D'Cruze, Regional Officer, Disaster Management and Development, Caritas Rajshahi
- Golam Rosul, Regional Officer, Disaster Management and Development, Caritas Rajshahi

Bangladesh University of Engineering and Technology:
- Dr. Mohammad Shariful Islam, Associate Professor, Department of Civil Engineering
- Dr. Tahsin Reza Hossain, Associate Professor, Department of Civil Engineering
- Shamima Nasrin, master student

Other:
- Samuel Berthet, director of Alliance Française Chittagong
- Rev. Gervas Rozario, Rajshahi Bishop

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